Risk and Competition in the Indonesian Private Banking Market: An Asymmetric Rivalry Within and Between Strategic Groups

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Abstract

This paper tests the interrelationships among risk, competition, and efficiency in the Indonesian private banking industry between 2014 and 2018. We examines asymmetric rivalry within and between strategic groups defined according to the size of their members. We hypothesize that, owing to several forms of group-level effects, including price difference and efficiency, strategic groups comprising large firms expect to experience a large amount of retaliation from firms within their group and accommodation from the group comprising smaller firms. The competition of private banking is dominated by incumbent firm. The risk and efficiency evolved over time enjoyed by incumbent with fat cat taxonomy and quiet life hypothesis. The entrant play lean and hungry strategy in different market segment within strategic group, whereas foreign bank deter incumbent with higher prices to enter between strategic group. The competition of private banking in Indonesia dominated by risk appetite and fragmented market.

Keywords: Market Structure, Risk, Efficiency, Indonesian Private Banking
JEL: G24, G32

1. Introduction

Since global economic crises in 2008, wealth and private banking is one of the fastest growing segments on banking, in particularly for the emerging economy (Bryane, et al., 2015). Mishra and Meyer (2019) reports that high net-worth individual (HNWI) in emerging economy is outstanding. The HNWI household estimated at 3.68 million with about 12.0 trillion in the Asia-Pacific region. According to Asia Pacific Wealth Report 2012, Indonesia was a fastest HNW client's growth rate (24.7%) than other Asian countries.

If we compare to the world private banking system such as in developed countries, private banking system in Asia has different perspective especially in competition aspect. Mishra and Meyer (2019) noted that wealth manager in Asia typically focus on top line revenue increases rather than an advisory relationship. Usually, the wealth manager less stick to compliance and risk management practice that led to increasing cost of doing business. According to Santacruz (2018) the competition for managing the assets in Asia-Pacific HNWIs is becoming increasingly crowded. In

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fact, The Asia's traditional banking center such as Singapore and Hong Kong is under competition from emerging Asian centers such as Shanghai (China) and Jakarta (Indonesia).

As the fastest growth of HNW client and emerging Asian wealth market, Indonesia have benefited from its domestic market (Santacruz, 2018). Although private wealth management has not been a major financial activity, local banks and wealth managers are encourage HNWIs to get wealth management services. Along with increasing of rich population and middle income class, emerging of HNWIs have created a new demand on stronger wealth management market.

Private banking services in Indonesia usually serve for high net worth household with their minimum deposit between US$ 35.000 – US$ 70.000[6]. The private banking sectors in Indonesia has been emerge as a new market segment. Along with its consistence pace of economic growth, the private banking sectors become potential market for both domestic or foreign investor to enter in this market segments.

According to Mishra and Meyer (2019) and Santacruz (2018) the competition of private banking system in Asian market shaped of a higher appetite for risk, fragmented market, intergenerational transfer and greater awareness of private banking. Otherwise, in traditional system or private banking likes Switzerland system, developed through strong bank-client relationship over generation and focus on capital preservation rather than wealth accumulation. It is confirmed in recent study shows that greater market power fueled by higher economic growth like Asian countries tends to temper risk taking incentives (Soedarmono et al., 2013).

This paper intend to investigates more deeper the connection **between risk and competition of private bank sector in emerging markets such as Indonesia.** How customer attracted to deposit their money in private banking services based upon the profile of bank. According to Leland and Pyle (1977) the willingness to invest of deposit customer through signal of lending market. When customer has good signal that bank has a value on the project that reflect the information transfer by the price of output (i.e. deposit interest rate and/or lending interest rate). The customer will attract to deposit their money.

In private banking sector, for both deposit and lending performance is a credible signal for depositors for preserving of their capital and insuring the safety of their deposit. On the other hand, in moral hazard of banking industries, this information is restricted. The gap information between customer and bank performance has led the market in different properties of market equilibrium. These differences caused by different deliverance of information either with no information, with or costless information. Unless, we assess the signaling of equilibria of the industry in market through efficiency (Leland and Pyle, 1977).

In addition, Thakor (1996) emphasized that the asymmetric information of bank lending gives uninsured depositors to monitor loan quality and to price of its risk. When the bank be able to manage its risk signal. It reduces the cost of protecting capital, increasing of assets quality and generating higher expected return (Hughes and Mester, 1998). In fact, according to Burgstaller and Cocca, (2011) in private banking market, the risk and return factor is not merely driving force of competition factor. In addition, efficiency and switching cost are the crucial variable for deposit bank to locked-in the depositor (Carbo-Valverde et al., 2011). Más-Ruiz et al., (2014) also support that elaborating efficiency and switching cost as a retaliation among strategic group play importance role to determined degree of strategic interaction of banks.

[6] Survey was conducted in 2019 for private banking services across 102 banks.

There is a remain unexplored study for private banking that linkages between risk and competition in Asian market especially in Indonesia. We conduct the competition approach with conjectural variation. This approach quantitatively assessed the persistence of competitive interaction model between strategic firms and its heterogeneity factors. This approach has been called as New Empirical Industrial Organization (NEIO) frameworks (Dranove et al., (1998), Peteraf and Shanley (1997), Bresnahan (1992).

There is still limited empirical evidence for predicting private banking market interaction with the nature of competition with conjectural variation approach. To best of our knowledge, assessing competition with conjectural variation method to assess strategic rivalry with asymmetric competition approach in private banking has not been conducted by previous studies. Most of empirical evidence for private banking literature, were conducted by literature review and qualitative analysis without strong quantitative assessment such as Briyane et al., (2015), Mishra and Meyer (2019), and Walter and Sisli, (2007). In addition, there is still limited references for single country analysis about private banking competition. Although some author such as Ting, (2017) study about factors affecting wealth management services in Taiwan. The study does not assess the competition aspect of wealth management services.

2. Literature Reviews

We embarked the linkage between competition in private banking according to Boyd and Nicolo (2005). He stated that when the competition intense in loan market, bank will decrease the deposit interest rate that affect on situation that is close to default. Increasing in competition will increase their risk taking, unless they manage their risk through efficiency.

Maudos and de Guevara (2007) classified market power and efficiency based upon efficient structure efficiency hypothesis, that the most efficient banks obtain both greater profitability and markets shares as a consequence the market becomes more concentrated (Demsetz, 1973). Another hypothesis says that market share capture by factor unrelated to efficiency such as market power and product differentiation (Shepherd, 1986). In addition, as a special case of market power hypothesis such as quiet life hypothesis stated that, when bank has higher market power, the lower effort of managers to maximize operating efficiency. If we connect the competition, risk, and efficiency in private banking, the efficient in scale of operation is a crucial factor. Specialization and investment performance as an important factor that bank become more efficient (Burgstaller and Cocca, 2011).

2.1. Competition

According to Shaffer and Spierdijk (2017) there are six indicators that measures a market power. The pivotal aspect to measure competitive benchmarks is marginal cost of production that compare to output price, the effect of price and quantities that sold on customer and elasticity of demand by the consumers. Among those indicators, we focus on Rothschild - Bresnahan conduct parameters (conjectural variations parameters) that explicitly performed oligopoly equilibrium concept.

We defined that competition of private banking in Indonesia is in oligopoly equilibrium. The reason why we choose this assumption because market concentration of private banking services in Indonesia dominated by several banks with larger assets, corporate governance ownership, and specific market segment (local and sharia bank). In addition, the private banking services is new

growing activity of bank along with other main activities. In order to attract private bank customers, the first signal that bank should offer is basic information of their entire activity to customer that usually provides through public disclosure such as income statement and balance sheet.

Therefore, applying conjectural analysis for private banking in Indonesia is adequate for capturing behavior of banks to attract consumers. This approach can mapped direct to explicitly oligopoly equilibrium concept in both static and dynamic models. Its portray structure of bank market power on the input side as well as the output side. The approach can decomposed into bank industry from upstream and downstream components with rigorous theoretical underpin and clear economic interpretation (Shaffer and Spierdijk, 2017). On the other hand, this approach has been well known with operational complexities and difficult to estimate.

The conjectural analysis heavily rely on econometric estimation that conduct in following steps; (1) estimating marginal cost as a basic estimation that incorporate into conjectural equation, and (2) estimation of conjectural equation where the analysis incorporate marginal cost, price estimation as well as demand estimation in the model. Whilst, strategic interaction is estimated through conjectural parameters that reflect on interaction quantities / prices between banks. There are several research that conduct this approach such as Mas-ruiz et al., (2014) for banking sectors in Spain, Shaffer (2004) for banking sectors in United States, and Uchida and Tsutsui (2005) for banking sector in Japan. Most of those studies were conducted with econometric estimation and depict the linkage Cournot duopoly for banks with Rothschild – Bresnahan Index (conjectural equation).

The Rothschild – Bresnahan Index calculated as the following formula

$$(1)\ CVI = \left(\frac{P-MC}{P}\right) \cdot \eta$$

Where CVI is conjectural variation index; P is price of bank output, MC is marginal cost of bank, η is elasticity of demand $\eta = -D \cdot P/Q$. Where Q is quantity of bank output. Several studies (Mas-ruiz et al., (2014), Shaffer (2004)) proxies P as price of lending interest rate or price of deposit interest rate of bank to the consumers. Q is quantity of demand that proxies as outstanding balance of bank activity. Uchida and Tsutsui (2005) defined Q as outstanding balance of loan for bank, Shaffer (2004)defined Q with quarterly revenue, Mas-ruiz et al., (2014) defined Q with total value of either loans or deposit.

Walter and Sisli (2007) emphasized that private banking industry is strongly related to assets management services. Creating value chain through cross link services by establishing cost effective distribution of assets management services by various kind of remote marketing technique. The bank should provides strong infrastructure and other financial intermediaries like insurance companies, mutual fund supermarket and financial management consultant. These endeavors proposes by bank to lock-in the depositors in order to keep the service and sustain their market power (Carbo-Valverde et al., (2011).

In order to compete in their strategic group, the bank attract depositors as new customer or shift from other customer to be their customer (Hughes and Mester, 1998; Leland and Pyle, 1977). If we follow new empirical industrial organization (NEIO) framework. The private banking competition should measured through market conduct and unknown cost parameters. The market sensitivity measured by responsive of price to change in demand elasticities. We considered that our study

from the consumer perspective rather than producers perspective, the consumer expectation of their investment should be elaborated in the model. In consumer perspectives, the price shaped by symmetric firm that retaliate between private banks. Hence, the price of private bank output defined as the difference between bank-i and bank-j (Farrell and Klemperer, 2007).

Accordingly, in order to measure the competition of private banking in Indonesia the structural model that formed conjectural equation should be incorporated the price difference between banks. The conjectural equation should incorporate structural function such as marginal cost, supply and demand function. On the other hand, Shaffer and Spierdijk (2017) highlighted that estimating this structural model requires estimation of a system of equation that is non linear. On the other hand, most of the studies were conducted with simultaneous linear estimation such as 2 Stage Least Square (2SLS), and 3 Stage Least Square (3SLS). There are some urgent note that should be check within the estimation especially marginal cost should be properly specified and theoretically valid when the marginal cost function are exactly linear an close to zero.

2.1.1. Strategic Group Rivalry

The competition will occur within their closest competitor that have similar endowment factors. The endowment factor depend upon various resource input that bank can compete with others. Accordingly, this resource input will shaped bank to compete with specific market segment or other factors. When bank have similar endowment and market segment, they will evolve and promote their competition within their factors. The similar endowment and market segment creates strategic group rivalry. Porter (1979) called this situation as strategic group rivalry. On the other hand, along with dynamic structure of bank, the competition shaped their action into strategic rivalry to survive in the market. During this competition process, in order to survive bank act strategically by improving their value creation and creates new groups into better group or lesser group. Along with process this group is mobile, if the bank in the lesser can improve their performance to jump into better group, whereas in better group unable to sustained and shift to lesser group. This mobility process of between group process according called as intra group (Peteraf ,1993; Caves and Porter, 1977) The shifting from lesser level into better level of group rivalry as new market segment. It's called as between group rivalry.

The formation of strategic group in market concentration perspectives determined by resource input and managerial performance to dominate in the market. In order to

In terms of competition assessment through strategic groups rivalry, the theoretical basis prior to strategic group interaction have demonstrated by Más-Ruiz et al., (2014), Más-Ruiz et al. (2011), Más-Ruiz et al., (2005). We employ they procedure to identify whether private banking sector is formed based upon the emergence of private banking groups, intra- and intergroup rivalry, performance differences between group and stability of group structure.

In order to defined clearly about group classification to distinguished the terms of within and between group in this paper. We define that within strategic group as a strategic group that have similar resource such as financial performance, risk, and other factors. This performance will shaped its specific group naturally according to their assets, profit, customer, risk, efficiency and so on. The between strategic group is the group outside within group that could be higher or lowered performance than within strategic group. This group shaped according to their performance that distinguished from within group.

These factors will determined whether the group within or between are getting closer or distance, or even jumped to another group. Along with these strategic action, Más-Ruiz et al., (2014) offer systematic and predictable approach to investigates asymmetric of within (intra) and between (inter) group rivalry in private banking industry.

The emergence of strategic group. Increasing demand of private banking sectors in developing countries triggered by (a) education planning and borrowing allow for greater family earning power; (b) wealth managers can offer premium clients higher-return investment; (c) larger role for retirement savings and estate planning; (d) large role for life, health, and disability insurance; (e) offer of small and medium business accounts to complement wealth management accounts; (f) prospecting for wealth families increases portfolio and client size (Bryane et al., 2015).

These aspects have stimulated private bankers and wealth managers in developing countries provides efficient institutions and freedom of the rule of law for the customer to deliver quality of services offered in terms of cost, return on assets, return on equity, cost income ratios will impact on volume and value of private banking clients.

In term of supply Mishra and Meyer, (2019) report that the emergence of private banking in Asian countries stimulated by (a) entrepreneurial activities; (b) clients have a perception that the wealth management industry can add to the wealth accumulation; client expect the wealth management will grow their wealth rather than preserve it; (c) there is an intense competition between wealth managers that focus short term results rather than advisory relationship that usually require in long term relationship. In fact they underline that wealth manager in Asia less experience rather than in traditional Switzerland system that usually embed with mature talent in wealth management; (d) the private banking sector in developing countries is not stick to compliance and risk management practices with international standard that stimulates higher cost of doing business.

If we looking at those studies, the emergence of strategic group of private bank in the emerging economies based upon their performance and elaborating their risk due to entrepreneurial activities. The private banks depends on their efficient institution and quality of services as well as their strategic interaction with their closer competitor. This performance not only that shaped its market segment but also as a barrier of between group to enter within market segment group. The ability of bank to sustained and enter this group will rely on strategic action to imitate or followers (Dranove et al., 1998). In NEIO framework, analyzing this inference of market power can be predicted by estimating of behavioral equation by which bank set price and quantity as well as their factors to dominate in the market. The retaliation between banks should predict the strategic interaction at the industry level. How their performance differences closely related to markets power (Bresnahan, 1989).

We hypothesized that the emergence of private banking in Indonesia shaped by actual behavior relation and interaction of Indonesian banking performance. This emergence portrayed the interaction of the bank according to bank size, risk and return performance that deterring its strategic group as a mobility barrier from outside group of bank. We classified that private banking in Indonesia distinguished into four classification as noted by Mishra and Meyer (2019) such as universal bank, local bank, foreign bank, and particular bank that has been emerge in Indonesia as the largest of muslim population in the world that is sharia bank.

The rivalry within and between strategic groups. The anatomy of competition between firms consist of rivalry between firms or group. According to Smith *et al.* (1997) the fundamental question of determining rivalry is not to compare the rivalry within or between group. The competitive responses cannot be predicted by strategic group membership. Otherwise, strategic group membership is a predictor by which firms compete with one another and how they undertake competitive actions, cut prices, instigate warfare and imitate rivals.

Peteraf (1993) distinguished the strategic group into within/between group hypothesis that rivalry occur according to within and between group.

- The within group argument stated by Porter (1979) that industry composed into cluster or groups of firms with similar strategies called as firms within group. This within firm behavior have group resemble one another, recognize their mutual dependence closely, and to be able to anticipate each other reaction accurately.
- Otherwise, between strategic group the situation is difference.

According to Beck and Levine (2008) the presence of firm to stay within this strategic group determined by two ways that is

a) First , *creating barrier to entry within strategic groups* by improving the capability of outside firm to entry into this group depend upon as follows (i) bank characteristics i.e. larger total assets, economic scale and efficiency; (ii) contractual and informational framework i.e. the ability to reduce asymmetric information and adverse selection of effective contractual and information frameworks, (iii) market structure i.e. bank concentration system that led to market power or ownership type can determined market structure of private banking, (iv) regulatory restriction on bank activities and entry i.e. the degree of regulation on financial market and the presence of stated owned banks as well as fraction of bank application denied, (v) transparency i.e. the disclosure information that client have more access to information and (vi) physical infrastructure i.e. information and technology that associated with cost of doing business for banks to serve their client.
b) The *second barrier is the presence of multiple strategic groups* affect on process of competitive rivalry. In this barriers, the firm with superior bargaining power will determined the competitive structure within group. These factors are not only determinant of firm enter within strategic firm, but concomitantly as general barrier of bank to entry in difference level of market in which they operate and competitive pressure they face (Beck and De La Torre, 2007).

The degree rivalry between groups are greater than rivalry within groups (Porter and Caves, 2010). Mas-ruiz et al. , (2014) find that competitive interaction within and between strategic group of loan market in Spain are both asymmetric and the dominant fringe type. The large firm expect to experience strong reprisals from other firm in other group and no reaction from the medium firm and the small firms.

We hypothesized that rivalry within and between strategic group in private banking are not far and much closer with Spain case. The medium, local and foreign bank in Indonesia unable to retaliate with universal bank. They tend to imitate and follows these banks because the larger group more determinant on the market power, and attempting to differentiate market segment to avoid competition with incumbent bank market segment. There is a dominant fringe type of asymmetric rivalry on private banking as noted by Dranove et al., (1998).

Performance difference between group. As we noted earlier that performance is a crucial factor for strategic group to stimulate their rivalry as a retaliation instruments to compete between firms.

When a firm has better performance than others for managing their risk, return, and efficiency. The firm creates its own barriers by covering the cost to achieve that performance (Dolnicar et al., 2018). These factors will creates rigidities for a bank to stay in market segment and barrier for other to enter the market. The strategic group produces relative cost of advantage over other firms and group (Porter, 1979). According to this characteristic, group creates its barrier that produces market power, efficiency and risk called as mobility barrier (Dranove et al., 1998).

The sustainability of firm to stay within or between group determined by their strategic interaction to manage their performance. If one firm unable to retaliate with other firm within group, they will open other firm to entry or replace its own position. Therefore, the retaliation of firm to others or vice versa is always a learning process for firms to be a persistent member or temporary member in the market (McGee and Thomas, 1986). This process portrayed through price interaction of firm with others either the group attempt to deterring competitor to gain entry into group or enhancing strategic among members (Mas-ruiz et al. 2014).

We can argue that private banking in Indonesia will follow the proposition of cost efficiency among strategic group and focus on delivering value added product to differentiate their value and transparence around the product pricing to link between fees, risk and performance.

Stability of group structure. After we discussed the strategic group behavior since the emergence, how the rivalry behavior within and between as well as performance impact on rivalry behavior. At this moment we are going to discuss about how the strategic group can sustained and stabilized in dynamic structure. The strategic group is change over time, it is grow, evolve, and decline (Hatten and Hatten, 1987). This dynamic structure affected by their member along with their strategic interaction behavior. The response of firms within their group, create collective strategies due to homogeneity behavior in their strategic group. This homogeneity will interrupted by periods of change then reshape the formation of strategic group (Fiegenbaum and Thomas, 1993). Basically, the group structure is unstable due to their response from the environment. The environment will push the firms to change their strategic behavior and adopt the collective strategies among its group members (Mas-ruiz et al., 2014).

The firm should change their strategies because they should response on imitation action of other firms by copying their behavior, and realigning their position within their market power due to external environment (Fiegenbaum and Thomas, 1993). It is hard for firm to keep their structure static without coping strategy with dynamic industrial environment. This dynamic process includes the strategic action of firms to deal with their performance, price difference , risk and efficiency.

We hypothesized that dynamic group structure of private banking in Indonesia formed by its dynamic effect of price difference, risk and efficiency. These factors stimulates bank to adapt and coping their strategies along with external factors such as macro economic condition or other environmental industry factor (Bryane et al., 2015). The strategic group are interactively cope within group and managing their risk, efficiency and price difference to cope with external environment.

2.1.2. Asymmetric Rivalry Within and Between Group

According to Hatten and Hatten (1987) the barrier to mobility between groups called as asymmetric, this occur when the cost of imitation are high and efficiency or managing risk are superior within strategic group. These parameters called as barriers of other firm to entry within group. The asymmetric rivalry behavior can be defined as a function of which competitor of banks

unable to imitate strategic action symmetrically with other banks. This asymmetric competition based on strategic difference of bank performance to cope strategic behavior with their competitor in term of price difference, efficiency, risk, and return.

In fact, Porter, (1979) defined that rivalry is not symmetric but rather is asymmetric that portrayed strategy differences where preferences, information flow and relative power among firm is asymmetric. The impact of rivalry on a firm will determined their resources i.e. number and size distribution, strategic distance between group and market interdependence among group to retaliate other players. How the present bank in Indonesia competing for same private banking customer rather than customer in distinctly market segment. The diversity strategies for each banks to attract private bank services will enhance rivalry among bank.

Desarbo and Grewal (2008) added, that competition among firms also hybrid, firms within strategic groups generally adopt similar strategic recipes and compete more intensely than firms across strategic groups. They find that hybrid strategic group outperforms ordinary clusters analyses and offer critical insights into the nature of competition among firms.

If we linkage the asymmetric rivalry concept with the evolving of strategic group rivalry. The asymmetric rivalry is an instrument for strategic action for the firm to maintain its dynamic structure in the market. In order to illustrates this evolving process and how the strategic action operate in private bank sector we can employ response for each firm in each strategic group members according to Fudenberg and Tirole (1984). At the first period, while market dominated by the incumbent based upon their performance such as risk, return, or efficiency. How these dimensions work, by employing Cournot-Nash equilibrium that entrant will deter the incumbent according to their price. In the first period, the incumbent of private banking completely dominate the market whereas entrant unable to produce revenue. In order to deter incumbent in various strategic group, the entrant lowered their price by applying adoption, imitation of incumbent behavior to be more efficient or take risk appetite to enter the market. The behavior of incumbent to rebuttal this action, depend on their investment expenditure on reaction curve. The reaction curve rely on incumbent investment whether they behave will be upward or downward slope against the entrant.

The upward slopes in reaction curve indicates that firms (incumbent firms) reduces its market share due to entrant, whereas downward slopes represent increasing market share of incumbent firm than the entrant. There are many strategies if incumbent to maintain their market. There are important assumption according to these taxonomy, that the taxonomy exist in the second period reaction and investment is the pivotal factors that incumbent whether accommodate or deter the entry. We use these strategies to applied in private banking in the following ways:

1. If the incumbent firm has reaction curve with **upward slope**, the following action that incumbent should do that is whether incumbent should tough or soft; in order to make **tough** or **soft** its depend on investment of incumbent to accommodate or deter the entry. If the incumbent
    a. **tough** due to their overinvestment as shown by its performance (i.e. deposit rate, return on assets, return on equity, credit risk, price difference, efficiency, insolvency risk, liquidity risk, etc.) so the act of incumbent to deter entry in the market should be *Top Dog*. Which means, the entrant should compete head to head in terms of its performance with incumbent. Otherwise, the incumbent is underinvestment strategy in tough cases because incumbent expecting the entrant due to limited capacity for providing service in the market its called as *Puppy Dog* strategy (Gelman and Salop, 1983). We hypothesizes that tough case with puppy dog

strategy will be exist in case of private banking in Indonesia especially at the rivalry between group. Along with high economic growth and fastest growth on HNWI's and limitation of national banking for private banking services. The underinvestment of incumbent and existing regulation accommodate entry in the market whether local or foreign bank to deliver services. As noted earlier by Mishra and Meyer (2019) that the risk appetite and market potential in emerging economies will attract private bank to enter this potential segment, whereas most of existing bank has limited on private banking.

   b. Otherwise, for **soft** case if the incumbent has overinvestment strategy, they will act as a *Fat Cat* to accommodate the entry. The fat cat strategy is incumbent to play less aggressively in post entry, because they believe with their investment such as in advertising or technologies that push their rivals become less aggressive. On the other hands, another soft case strategy in called as *Lean and Hungry* (Gilbert, 1989). The incumbent is in underinvestment strategy to be tougher in order to prevent entry calls. We consider that Fat Cat strategy is exist in Indonesia private banking when incumbent banking (i.e. larger firm size) such as universal banking face up to local bank and foreign bank, it indicates most of universal bank dominates by the corporate government bank in terms of output, assets and customer.

2. If the incumbent has reaction curve with **downward slope** which means that incumbent in the second period has increased its market share. When incumbent face this situation, they will accommodate entry for entrant either tough or soft by applying investment that followed by entrant with similar or adoption strategy.
   a. The incumbent is tough if they overinvestment than entrant and act as top dog. The incumbent has strong performance. They are efficient, well performed in managing risk, highly price difference, and good in return. This strategic act will deter the entrant unless they adopt incumbent performance as a top dog;
   b. On the contrary, the incumbent is soft when they underinvestment than entrant and act like lean and hungry. Consequently, this strategies trigger the entrant to follow this strategy in order to accommodate the entry.

As matter of fact, for downward conditions, we hypothesized that the private banking sector in Indonesia it seems exist especially for universal bank whilst local bank imitate and adopt their strategies to accommodate entry. The local bank or medium size bank will adopt the larger size bank. On the other hand, the top dog strategies will exist especially between national bank and foreign bank.

2.2. Risk and Efficiency

Fiordelisi et al., (2011) and Berger and DeYoung (1997) classified hypothesis that linkage between risk and efficiency consist of (i) *bad management* hypothesis where bank operates with low level of efficiency but improving their revenue. They will take more credit risk by increasing additional cost for monitoring and control in their operating expense. Therefore, when the bank take more risk, they will be less efficient and unable to compete in the long run due to their increasing inefficiency in the future; (ii) *bad luck hypothesis* state that bank unable to cope their performance due to external shock. When there is an exogenous event affect on loans, the bank covered this risk by increasing additional cost and managerial effort. These consequences led bank to decrease their cost and revenue efficiency and maintain the competition in the near future; (iii) *skimping hypothesis* that is when bank valuate credit risk based upon under writing assets rather than loan performance. The bank will faces loan problem in the future and produces possible cost for the bank to manage the credit risk in the future.; (iv) *moral hazard hypothesis,* that bank and owner have moral hazard to reduce informational friction in order to maintain risk and efficiency to

stabilize their competition in the market. When bank face agency problem between bank manager and owners, it will trigger untrustworthy between them. Bank managers could take more risk to get more incentives when the bank capital is low and inefficient. However, although bank is well capitalized, this not a guarantee that bank adopt cost reducing strategies. Shareholders should more active in controlling bank cost or capital allocation.

In private banking sector, to be efficient in scale is most logical strategy to compete in the market. It will difficult in private bank market offer their services with higher deposit interest rate. This policy will increase the loan rates and affect on higher risk taking in investment. Increasing the cost of fund will reduce bank performance to compete in the market and reduce market power accordingly. In order to compete in the market there is two strategic actions that bank does. *First*, private banking should attracted manager who are more skilled in controlling cost and produce scale effect (Cocca, 2008). This situation is reasonable if the bank has larger size in assets. Larger bank has capability to offer higher margin to attract more fund. *Second*, bank should concerned in specialization activity. They should measured share of income from fees and commission in total income to generate their revenue from private banking activity. According to those aspects, bank offer their service by identifying their peers according to asset size and product mix.

Mishra and Meyer (2019) report that, the risk appetite of private bank customer in the emerging economy have returned after global financial crisis of 2008. The universal bank as the larger banks introduce private banking as a peripheral division without a real strategy on client acquisition. The private banking almost an add on of corporate and retail banking, therefore a private banking largely evolved as a product platform. The local banks as a second group of private banking in emerging economy, they have large client base but largely focused on mortgage lending and distribution of retail investment product. The local bank is required for the client to improve their private banking product and services as well as their strength on local market knowledge. In addition, private banking customer in emerging economy spread their assets over a few banks and will shop around for the best deal in terms of price or return. This lead that private banks have lowered margin and increasing risk to compete with their peers.

3.2. Data and Methods

3.2.1. Data and Sample

Due to their growing market and marketing strategy intelligence it is difficult to get private banking data publicly. Therefore, we collected private banking data with survey. Where the data are strictly confidential, we only provide an abbreviation for the data that shows in our study to ensure the data is strictly confidential.

The data were collected during September – November 2019 from 64 high level position of bank managers such as Vice President, Senior Vice President and Director across 32 banks. The banks includes universal bank, local bank, and foreign bank. The data that we collected were information about general profile of managers, growth of private banking customers in the latest five years, number of private bank customers, as well as minimum deposit requirement for each customer.

After we validated and verified the survey results, only 19 banks have consistent data in terms of private banking and other indicators. These data includes number of private bank customer, growth of private bank customers and other market data profile. Especially for customer private banking, we interpolate the private banking customer according to survey of growth that respondent answer in the questionnaire.

The secondary data were collected from Financial Services Authority website[7]. We retrieved the data such as balance sheet, income statement to measure financial, risk and cost performance in last five years period that is 2014 – 2018. We distinguished the dataset according to three group of data sets that is

1. We classified risk into credit risk (i.e. ratio of equity and assets , ratio of loan losses reserve to credit, ratio of credit to assets), operational risk (i.e. ratio of labor expenditure to other expenditure), liquidity risk (i.e. ratio of deposit to assets, ratio of total of cash account receivable and securities to assets) and general risk (ratio of profit to assets); We choose accounting risk measures rather than other risk measure because these indicator are available publicly and easy to compute. Hence the public can evaluate this risk practically without extra effort;
2. As we noted earlier we classified bank according to their market segment and ownership. We clustered the bank according to Mishra and Meyer (2019). The member of Universal Banks are MND, BCA, PMT, MEG, BTN, BKP, MDT. This banks have larger bank size than other banks. Foreign Banks is CTB, OCN, STC, MYB, HNB, UOB, CMW, RAB, QNB; Local Bank is BJB, JTM, SSL; Sharia Banks: MML, MDS, BNS.
3. to P_i is price of private banking for every bank that bank-i offer private bank as *interest expense divided by total private bank deposit* ($TPBD_i$). We calculated Total Private Bank Deposit from survey by estimating number of private bank customer (Q_i^{pb}) and average of private bank who deposit in the respective bank (PB_i), then we have $TPBD_i = Q_i^{pb} \times PB_i$. In order to calculate growth for five years back, we calculated according to manager response about five years growth; Total Assets, Total Equity, Profit, Fixed Assets were obtained from balance sheet.
4. Cost data sets includes (y_i) outputs that consist of lending (credit), deposit were obtained from balance sheet. $TPBD_i$ were estimated as noted in the first point. w_j price of input such as price of deposit ($r_{d,i}$ - *interest expense divided by total deposit*), price of lending ($r_{l,i}$ - *interest expense divided by lending*) and price of private banking ($r_{pb,i}$), σ_i is risk factors such as credit risk, liquidity risk, or general risk Operating cost, personnel cost, and other operating cost were obtained from Income Statement;
5. Conjectural parameters of demand parameters such as GDP_i is gross domestic product, GDP per capita Risk Free Rate (Central Bank Rate) were obtained from World Bank Development Indicators (WDI)[8].

For detail information of variables definition we presents in Table 1 as well as Descriptive Statistics of the variables in conjectural variation model (Table 2) and translog function model (Table 3).

[7] https://www.ojk.go.id/id/kanal/perbankan/data-dan-statistik/laporan-keuangan-perbankan/Default.aspx.
[8] https://datacatalog.worldbank.org/dataset/world-development-indicators

Table 1. Descriptive Statistics

Variable Name	Description	Num. Of Obs.	Mean	Standard Deviation	Min	Max
Risk Factors 1	Credit Risk 1 = Equity / Assets	2,725	0.1224951	0.0434419	0.0094327	0.2714576
Risk Factors 2	Credit Risk 2 = Loan Losses Reserve / Credit	2,650	0.0223265	0.0199255	0	0.1200315
Risk Factors 3	Credit Risk 3 = Credit / Assets	2,725	0.5828503	0.1642304	0.12424	0.8086935
Risk Factors 4	Liquidity Risk = Deposit/ Assets	2,725	0.3873867	0.1395339	0.1043069	0.7234835
Risk Factors 5	Operational Risk = Labor Exp./ Other Exp.	2,700	0.3162932	0.1248076	0.0244551	0.643753
Risk Factors 6	General Risk = ROA	2,725	0.0104736	0.0138956	-0.0393104	0.0515063
Total Assets	Total Assets in Rupiah (mil)	2,750	139,000,000.00	216,000,000.00	-	1,040,000,000.00
Y1 ($TPBD_i$)	Private Bank Deposit in Rupiah (mil)	2,750	9,710,000.00	22,800,000.00	65,600,000.00	140,000,000.00
Y2	Credit in Rupiah (mil)	2,750	87,000,000.00	144,000,000.00	-	719,000,000.00
Y3	Deposito in Rupiah (mil)	2,750	43,200,000.00	50,700,000.00	-	247,000,000.00
Price of private banking (r_{pb})	P_{pb} = interest expense / private banking (%)	2,175	0.12	0.15	0.00	0.99
Price of deposito (r_d)	P_d = interest expense / total deposito (%)	2,725	0.10	0.04	-	0.23
Central Bank Rate ($r_{d_{macro}}$)	BI Rate (%)	2,750	0.07	0.01	0.06	0.09
GDP per Capita	GDP / Population	2,750	3,978.08	209.46	3,692.97	4,284.65
Ncust	Number of Customer of Private Banking (people)	2,750	6,633.67	8,564.79	131.22	52,000.00
Other Expenses	Other Expenses	2,725	7,804,250.00	10,300,000.00	-	47,800,000.00
Profit	Earning after tax	2,750	2,423,733.00	5,634,462.00	(6,495,521.00)	24,800,000.00
Labor Expense	Labor Expenses in Rupiah (mil)	2,725	1,867,770.00	2,628,455.00	-	11,800,000.00
Fix Assets	Fix Assets in Rupiah (mil)	2,750	4,203,524.00	8,324,702.00	-	46,800,000.00

Table 2. Correlation Matrix for Conjectural Variation Variables

	r_{pb}	Tot. Assets	N. Cust.	GDP/ Cap	$r_{d_{macro}}$	Oth. Expen
r_{pb}	1					
Tot. Assets	0.052	1				
N. Cust.	0.1707	0.9269	1			
GDP / Cap	-0.0143	0.0634	0.1296	1		
$r_{d_{macro}}$	0.0267	-0.0635	-0.1249	-0.9645	1	
Oth. Expen	0.298	0.8042	0.8372	0.0284	-0.0349	1

Table 3. Correlation matrix for Translog Function Variables

	Other Expenses	Deposito	Credit	Private Banking	Labor Expense	Credit Risk 1	Credit Risk 2	Credit Risk 3	Oper. Risk	Liquidity Risk	General Risk
Other Expenses	1										
Deposito	0.7318	1									
Dredit	0.8009	0.9535	1								
Private Banking	0.6595	0.6362	0.7777	1							
Labor Expense	0.8157	0.9113	0.9757	0.8617	1						
Credit Risk 1	-0.1037	0.1242	0.1909	0.2451	0.1956	1					
Credit Risk 2	0.359	0.2268	0.2477	0.1783	0.2415	0.1189	1				
Credit Risk 3	-0.0187	0.153	0.1984	0.1099	0.0866	0.3371	0.1738	1			
Oper. Risk	-0.4636	-0.0763	-0.0725	0.0028	-0.0672	0.3844	-0.2665	0.0385	1		
Liquidty Risk	-0.5188	-0.1986	-0.3501	-0.3653	-0.3792	0.0784	-0.3498	0.0619	0.3266	1	
General Risk	0.2317	0.2742	0.355	0.3742	0.3757	0.1571	-0.2116	0.0435	0.1357	-0.4543	1

3.2. Methods

In pursuance of assessing the linkage between risk and competition, we follow the analysis according to structural relationships of conjectural model. On the other hand, in the structural model we cannot investigates for each linkage directly in each structural relationship between risk and competition. Because, in structural model the analysis merely provides parameters for strategic rivalry of competition and the factors that affect for both demand and price function.

When there is no further information to investigates the linkage for each transmission between risk and efficiency as well as risk, strategic rivalry, and market power. We can test for each linkage by applying reduce form equations. In doing so we conduct for each analysis by performing reduce form equation that connect between risk, efficiency, strategic rivalry, and market power into two steps analysis that is (1) risk and efficiency, (2) risk and market power; while in the last sub section we performed the analysis (3) structural estimation of competition.

3.2.1. Risk and Efficiency

In order to test risk and efficiency, we can test the linkage according to Fiordelisi et al., (2011). We did not conduct granger causality test because our study limited sample only five years period. The reason why we have this period because we retrieved sample for private banking according to survey method. On the other hand, we still conduct the analysis without granger causality but we conduct the analysis with causality effect as follows,

(2) $CE_{it} = f(\ln TA_{it}, \ln Cust, RF_{it}^{a})$
(3) $RF_{it}^{a} = f(CE_{it}, \ln TA_{it}, \ln Cust)$

Where CE is cost efficiency, TA is total assets, Cust is private banking customer, RF is risk factors a consists of Risk Factor 1… Risk Factor 6 (RF1…RF6). We estimate equation (2) and (3) with General Method of Moment with Two Steps Estimation with corrected standard error (robust matrix) (Windmeijer, 2005).

The estimation (2) test whether Total Assets, Private Banking Customer and Various Risk Factors affect on Cost Efficiency. The Cost Efficiency was estimation with Stochastic Frontier Analysis that same estimation for marginal cost estimation. Whereas, estimation (3) performed to test whether Cost Efficiency affect on Risk Factors. We can test whether Cost Efficiency (CE) or Risk Factors (RF) affect more on both equations, by testing the parameter for both variables (CE and RF) have bigger parameters and significant.

3.2.2. Risk and Market Power

Applying strategic rivalry on risk management is a challenging issues. We should employ how the risk management for each bank in each clustered can compete in the market. The basic assumption we should set up that risk factor is a dynamic process. This dynamic factors should be incorporate into time varying bank characteristic. In order to analyzed between and within firm component. We can rely on variance analysis.

The logic that we propose the estimation is according to Porter (1979) that firm classification for firm into within or between is the closest performance of firms in the industry. We can use this definition by applying opposite indicators. That is, when the variance of risk between firms is getting close, the bank has indicated into similar behavior or vice versa. We can estimated this analysis by performing fixed effect regression by applying risk behavior as a group effect. Abowd, Kramarz and Margolis (1999) or called AKM have proposed an approach in labor market. When the

labor are move from one plant into other plant in the United States. We have an assumptions that bank and risk will be similar to the behavior of this situation. We can classified the strategic rivalry of banks can be good or not by classifying their risk management. If we assessed that bank has a good risk management we can assessed for each Risk Factors by applying binary 1 and 0. That 1 is bank has a good management risk if they can manage their risk and vice versa. For instance, we can give 1 for bank with good risk management if the bank can lowered their risk in previous period, otherwise 0 if they performed increase in risk taking behavior. The behavior of risk management 1 and 0, then performed as a risk mover whether bank can tackle their risk behavior.

$$(4)\ \mathrm{var}(\ln(Cust))_{it} = \underbrace{var(f(CE_{it}, \ln(TA)_{it}, RF^{a}_{it}, dC^{f}_{it})}_{within\ firm\ dispersion} + \underbrace{var(F^{c}_{it})}_{between\ firm\ dispersion} + var(\epsilon_{it})$$

In equation (4) we can analyzed whether risk is significant to increase on private bank customer or within firm dispersion. Which means whether the risk factors will be significant within its own group and creating barrier for other to enter this strategic group. Or, is there any dispersion from other group to enter between bank cluster.

3.2.3. Structural Estimation of Competition

We should portrayed bank heterogeneity with input and multiple output process that incorporate structural model competition with conjectural estimation. The equation should reflect Fudenberg and Tirole (1984) that each strategic action treats that indicates on marginal cost, demand and price function. In order to estimate structural equation of conjectural variation we estimate the conjectural equation according to

$$(5)\ P_i = C_i' - (Q_i \cdot C_i' \cdot \hat{\theta}_{ij}')$$

Where P_i is price of private banking for every bank that bank I offer private bank as interest expense divided by total private bank deposit, C_i' is marginal cost function as first order condition of cost (i.e. operating cost of bank), Q_i is demand for private bank sector (i.e. number of private bank customer or amount of private bank value), $\hat{\theta}_{ij}'$ is conjectural parameter that represent as price difference between bank i and bank j determined the price of private bank-i.

Equation (1) indicates that the price of private bank determined by marginal cost minus conjectural parameters. The conjectural parameters estimated through conjectural matrix as a payoff between bank-i and bank-j. The price difference of P_i' and response curve of demand for private banking customer (Q_i). We noted that if bank may creates positive prices, this condition will fulfill if the conjectural parameters larger than its marginal cost. Empirically, we derived equation (5) into econometric equation as follow

$$(6)\ \ln(P_i) = \psi_1 \cdot MC_i + \psi_2 \cdot \ln(TA) + \psi_3 \cdot \ln(Cust) + \psi_4 \cdot \ln GDP/Capita + \psi_5 \cdot r_{macro} + \epsilon_{\psi}$$
$$(7)\ \ln(Cust) = \delta_1 \cdot \hat{\theta}_{ij} + \delta_2 \cdot MC_i + \epsilon\_\delta$$

Where P_i is price of private banking, TA is total assets, Cust is number of private banking customer, GDP/Capita is Gross Domestic Product per Capita, MC is marginal cost. We estimate equation (6) and (7) through simultaneous equations. The equations (6) and (7) inform us that conjectural variation parameter estimated with macro variable. Equation (6) as the price equation assess whether private bank customer are attracted with respective private banking deposit rate. This equation indicates how the customer affect on deposit rate offer for private banking . Equation (7)

as a demand for private banking portrayed how customer attracted to be private bank customer through deposit rates along with increasing its marginal cost behavior.

The term of $\hat{\theta}_{ij}$ is price difference effect that associated with marginal cost with incorporate risk function. The association between price difference of private banking measure how the price difference between bank will attract consumer. If we follow recent study such as Carbo-Valverde et al., (2011), Gerritsen and Bikker (2018) the price difference will increase number of customer and have positive relationships. On the other hand, if we follow equation (5) when price difference associate with marginal cost. The effect will be negative. Risk factor that incorporate in marginal cost will change consumer preferences to hold their investment in private banking and change their preferences other than private banking services. When the price difference is wide, the logic of consumer will assessed their preference whether this price difference along with increasing risk. We expect that this terms will be negative due to consumer risk preferences to hold or avoiding in private banking.

We estimated equation (6) and (7) with System General Method of Moment (SGMM). We choose this approach to follow Shaffer and Spierdijk (2017) critique about the parameters that produce in simultaneous equation modeling, that parameter assumption should be 0. We consider that SGMM can solve this problem.

We classified risk into three six categories such as credit risk, liquidity risk and general risk. The bank affected by their risk through cost function. When the risk is manageable such as credit risk, liquidity risk, or general risk. Hence, bank will not pay more cost to cover the uncertainty of cost. In this cost equation, risk have internalized in cost factors as an effort of bank to minimizing of risk and cost. In order to estimate C_i' as a marginal function, we conducted with translog cost function that incorporated risk in the model. For detail of function please see Appendix.

$$(8)\ \ln C_i = \alpha_0 + \sum_i a_i \ln y_i + \sum_j a_j \ln w_j + \frac{1}{2}\sum_i \sum_j s_{ij} \ln y_i \ln y_j + \frac{1}{2}\sum_i \sum_j g_{ij} \ln w_i \ln w_j + \sum_i \sum_j d_{ij} \ln y_i \ln w_j + \frac{1}{2}\sum_i \sum_j d_{ij} \ln y_i \ln w_j + \sum_i \sum_j r_{ij} \ln \sigma_i \ln w_j + \epsilon_i$$

Where C_i' is operating cost of bank, y_i are outputs that consist of lending, deposit, and private bank, w_j price of input such as price of deposit, price of lending and price of private banking, σ_i is risk factors such as risk factors (RF1…RF6). We estimated equation (5) by Stochastic Frontier Analysis (SFA) with Seemingly Unrelated Regression (SUR) estimation.

According to equation (5) risk and other factors have positive relationship, when the cost or risk are increased the cost of bank will increase along with increasing in output such as lending, deposit, or private banking. Most of expected signs in equation (5) are positive along with other factors includes private market share function (demand for private bank) and capital function (cost of capital function). We assign additional equation in equation (2) that risk and cost determined by both market condition and investment of bank (capital). As we mentioned earlier, when the bank increase their investment to act whether tough or soft to accommodate market or deter the entry. Bank will act simultaneously and portrayed in their cost. Please see detail in Appendix B for further derivation.

The marginal cost estimation estimated by the equation

$$(9)\ MC_{it} = \frac{TC_{it}}{\ln y_{pb}}\left(\alpha_0 + \sum_i a_i \ln y_i + \sum_j a_j \ln w_j + \frac{1}{2}\sum_i \sum_j s_{ij} \ln y_i \ln y_j + \frac{1}{2}\sum_i \sum_j g_{ij} \ln w_i \ln w_j + \sum_i \sum_j d_{ij} \ln y_i \ln w_j + \frac{1}{2}\sum_i \sum_j d_{ij} \ln y_i \ln w_j + \sum_i \sum_j r_{ij} \ln \sigma_i \ln w_j + \epsilon_i\right)$$

Where MC is marginal cost, TC is total cost, $\ln Y_{pb}$ is output of private banking deposit, y_i are outputs that consist of lending, deposit, and private bank, w_j price of input such as price of deposit, price of lending and price of private banking, w_j price of input such as price of deposit, price of lending and price of private banking and σ_i is risk factors.

3.3. Limitation of Models

Our paper has a limitation is some respects that is (a) our period analysis is limited for five years and the limited sample banks, whereas the analysis the conjectural variations should be in longer period such as ten years period and more banks such as more than 100 banks as conducted by Más-Ruiz et al., (2014). This longer period can assess the path and behavior of risk and efficiency with more accurate behavior and smooth price behavior; (b) There is some aspect that should be carefully for adapting conjectural variation in financial product differ in fundamental ways from non financial product. In our model, because we incorporating risk form both sides that is deposit, private banking, and lending. A loan as an agreement on a dynamic reallocation of money between the borrower and the lender is an agreement for money at a fixed point in time. Therefore, the conjectural variation model ideally based upon net present value frameworks (Overvest, 2017); (c) our model is not in Nash equilibrium behavior, therefore we can suggest that next endeavor to include this approach in the modelling process.

4. Results and Discussion

In this section we are going to present our results according to our methodology and hypothesis argument. As we note earlier, that our analysis conducted in three consecutive steps. The first step is analyzing causality effect by applying reduce form equation to measure the linkage between risk and efficiency with GMM estimation. The second step is analyzing the linkage between risk behavior and market power with modified fixed effect regression; and the last is analyzing the structural equation of conjectural model.

At the first results that we presents is causality effect of cost efficiency and risk or vice versa. The cost efficiency were estimated with six translog functions with different risk characteristic that produce different efficiency. We provide detail of estimation in the appendix for complete results. Furthermore, in Table 4, we presents the estimation result of our reduce form model according to equation (2). We test that the whole risk are significant on cost efficiency of on private bank service. Only Credit Risk 2 (Loan Losses Reserve / Credit), and Credit Risk 3 (Credit / Assets) have negative relationship and significant on cost efficiency. On the other hand, for other risks such as Credit Risk 1 (Equity/Assets), Liquidity Risk (Deposito/Assets), Operational Risk (Labor Expenditure/ Other Expenditure), and General Risk (Return on Assets) have positive relationship and significant.

4.1. Risk and Efficiency

If we looking at the parameters at Credit Risk 1 at the first column in Table 4, the parameters shows that increasing ratio of equity to assets increases cost efficiency and vice versa. This results inline with the theory that increasing ratio of equity will increase assets, which means that bank has good risk management to ensure that equity and assets has positive relationship with cost efficiency. At this moment there is no significant risk of Credit Risk 1 can reduce cost efficiency in our sample.

At the second column in Table 4, that Credit Risk 2 has negative relationship with cost efficiency of private banks. This results inform us that there is increasing Loan Losses Reserve while Credit is increasing. This condition has been reduce cost efficiency. Which means, increasing of credit will

increase the Loan Losses Reserve and reduce the cost efficiency, because bank should provide more cost to cover default for credit. The parameter also towards to one, which means that increasing more lending will decrease the cost efficiency for competing in private banking. We can claim that there is a bad management hypothesis in the respective bank sample.

At the third column in Table 4, show that Credit Risk 3 has a negative relationships with cost efficiency of private banking. Which means that increasing of ratio of credit to assets, decrease efficiency. This indicator suggest that there is a bad management practices of credit and risk management that reduce the cost of efficiency. Its indicate that bank unable to allocate properly on the output. While its indicated that increasing deposit followed by increasing in assets, this activities reduce cost efficiency of bank.

The fourth column of Table 4 indicates that liquidity risk has positive and significant relationships. Which means, increasing deposit to assets increase efficiency. This parameters indicate us that increasing of deposit has been allocated properly to asses activity that produce efficiency. The activity can be opening more branch or other assets that attract consumer to deposit in bank sample.

The fifth column in Table 4 inform us that bank has manage operational risk to ensure efficiency. Although there is increasing in labor expense on the other hand other expense also increase along with improving efficiency. The sample bank has been good for managing their liquidity risk that produce bank increase their efficiency. In the last column of Table 4 its indicates that bank has a good in return and increasing their assets to increase their efficiency. This indication suggest that return has been properly allocate in assets to improve their efficiency.

If we looking at the results, banks has been allocated into asset to reach their market segments. It indicates the number of customer of private banking has positive and significant relationship with cost efficiency. This results support that private banking in Indonesia has been a prospect market for Indonesian bank to attract their emerging wealth consumer.

Table 4. Causality Effect Between Risk and Efficiency

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Cost Eff	Cost Eff	Cost Eff	Cost Eff	Cost Eff	Cost Eff
Ln(TA)	0.00990***	0.0148***	0.0222***	0.0136***	0.00395***	0.0169***
	(0.000556)	(0.000517)	(0.000897)	(0.000585)	(0.000377)	(0.000480)
Ln(Cust)	0.0163***	0.0134***	0.00406***	0.0129***	0.0135***	0.00442***
	(0.00103)	(0.00112)	(0.00127)	(0.00113)	(0.000705)	(0.00109)
cr_risk1	0.360***					
	(0.0289)					
cr_risk2		-0.737***				
		(0.0623)				
cr_risk3			-0.119***			
			(0.0123)			
liq_risk				0.0198**		
				(0.00775)		
oper_risk					0.573***	
					(0.00993)	
gen_risk						1.339***
						(0.0825)
Observations	2,725	2,725	2,725	2,725	2,700	2,725
Hansen Test						

Robust standard errors in parentheses : *** p<0.01, ** p<0.05, * p<0.1

Note: cr_risk1 = Equity / Assets; cr_risk2=Loan Losses Reserve / Credit; cr_risk3 = Credit / Assets; liq_risk = Deposit/ Assets; oper_risk = Labor Expd. / Other Exp; gen_risk = ROA; lta=ln(Total Assets); lcust = ln(Private Banking Customer)

Table 5. Causality Effect between Risk and Efficiency

VARIABLES	(7) cr_risk1	(8) cr_risk2	(9) cr_risk3	(10) liq_risk	(11) oper_risk	(12) gen_risk
Cost Eff	-0.00169	-0.0258***	-0.460***	0.654***	0.244***	0.0238***
	(0.00377)	(0.00174)	(0.0193)	(0.0100)	(0.0164)	(0.00132)
Ln(Total Assets)	0.00871***	0.00115***	0.0578***	0.0172***	0.0390***	-0.00124***
	(0.000200)	(0.000111)	(0.000665)	(0.000369)	(0.000768)	(4.95e-05)
Ln(Customer)	-0.00403***	0.00104***	-0.0333***	-0.0288***	-0.0496***	0.00305***
	(0.000374)	(0.000240)	(0.00134)	(0.000668)	(0.00178)	(0.000117)
Observations	2,725	2,725	2,725	2,700	2,725	2,725
Hansen Test						

Robust standard errors in parentheses : *** p<0.01, ** p<0.05, * p<0.1
Note: cr_risk1 = Equity / Assets; cr_risk2=Loan Losses Reserve / Credit; cr_risk3 = Credit / Assets; liq_risk = Deposit/ Assets; oper_risk = Labor Expd. / Other Exp; gen_risk = ROA; lta=ln(Total Assets); lcust = ln(Private Banking Customer)

If we compare the results of causality effect of Risk and Efficiency for both Table 4 and Table 5. If we looking at the parameter for each risk factors. Apparently, Credit Risk 1 has more affect on Cost Efficiency, rather than Cost Efficiency to Credit Risk 1. On Credit Risk 2, Credit Risk 2 has more effect on Cost Efficiency rather than Cost Efficiency. Moreover, Cost Efficiency has more effect on Credit Risk 3 than vice versa, Cost Efficiency has more effect than Liquidity Risk, Operational Risk and General Risk have more effect on Cost Efficiency. From these information, we can claim that only Credit Risk 3 (Column 9) and Liquidity Risk (Column 10) have more affected by Cost Efficiency rather than other risk factors such as Credit Risk 1 (Column 1), Credit Risk 2 (Column 2), Operational Risk (Column 5) and General Risk (Column 6) on Cost Efficiency.

These results suggest that for both Credit Risk 3 and Liquidity Risk 3, the risks are affected by Cost Efficiency. When the banks are inefficient will increase Credit Risk 3, whereas in Liquidity Risk, when the bank is efficient increase liquidity. For other risk its indicates that managing good risk factors will effect on Cost Efficiency. In daily practices, these results can stimulate improve their risk management especially in credit allocation. Increasing in credit allocation will reduce the efficiency. The growing of credit market such as in Indonesia requires more financial development and improving their literacy to get access for credit. While the demand for credit is increase significantly, bad management for bank to get risk appetite have reduce their cost efficiency.

4.2.Risk and Market Power

In this sub section we are going to test the linkage between risk market power through risk behavior of sample banks. We estimated for each risk factors on number of private banking customer as a market power for banks. For each estimation in Table 6 – Table 11 depicted for each Risk Factors effect on increasing of private banking customer. We estimate with fixed effect model associated with other control variables such as Cost Efficiency and Total Assets.

We include these variables because risk factors, cost efficiency and bank size are good factors for the private banking customer to invest in the sample banks. As we noted in literature review, that asymmetric rivalry of bank within and between group will occur through their performance such as cost efficiency and risk management. In our model, we incorporated these variables to proof whether these performance are important for bank to attract private bank customer. We defined that cost efficiency and risk management as an asymmetric rivalry variables that affect on market power.

In addition, if we conduct analysis with these variables without risk behavior it does not reflect how the bank can manage it risk to attract this behavior. Therefore, we presents the results from OLS estimation corrected towards Abowd et al., (1999) modified fixed effect regression In each table we performed six estimation that show the robust results of each estimation technique according strategic group cluster. The estimations were from OLS within and corrected with panel fixed effect model, followed by between strategic group estimation.

As we can see in each table, panel regression with AKM has offered better results in terms of better standard error, expected sign, and significance. We focus the estimation for within strategic group in column Panel Within Strategic Group whereas between group estimation in column Panel Between Strategic Group with AKM method. In order to test the results we looking at the Risk Factor for both within and between whether the parameters have correct sign and significance or not.

The effect of risk factors that significantly effect on number of customer of private banking are Credit Risk 2 in Table 7 and Credit Risk 3 in Table 8 in cluster between strategic group. On the other hand, General Risk affect significantly on private banking customer are exist for both within strategic group and between group in Table 11. According to these results we can stated that the risk factors that significantly effect on customer within group only general risk factor. The general risk defined as a ratio of return on assets. Its indicates that managing general risk behavior within strategic group will increase market power. If we looking at this results, return and assets is crucial factor for consumer to get private banking services. Within their cluster such as universal, foreign, local, and sharia banks, return and assets performance are a significant indicators that private banking customer will attract to invest in respected banks.

If we looking at between strategic group, the results confirm Smith *et al.*, (1997) finding that competition is not to compare of inter and intra group rivalry but how to group acts competitively in the market. These results also support managing better risk management practices along with cost efficiency and total assets are significance factor to attract private bank customer. The most significance risk that reducing private banking customer is increasing of Credit Risk 2 as the ratio of Loan Losses Reserve to Credit. In this estimation we support previous results that increasing of better management in credit risk assessment is a mitigation action for bank to reduce credit default in the future. The following results for Credit Risk 3 also support the previous results that increasing ratio of credit to assets decrease private bank customer. These results confirm the previous reduce form results as depicted in Table 4 and Table 5 that parameter have similar expected sign.

If we looking at the cluster effect in Table 6 - Table 11, the cluster effect are not significantly effect on market power. We can see the parameters (F1, F2, F3, F4) are not significantly effect on private bank customer. This means, that within strategic group there is not significant rivalry within of them. On the other hand, the strategic rivalry is exist to compete without boundary within strategic group otherwise bank compete with other strategic group outside their group.

Our results is different with Más-Ruiz et al., (2014), that in Spain banking industry there is within and between strategic group. This different led by the nature of bank industry between Spain economy and Indonesian economy. As we noted earlier, Indonesia as an emerging market has growing potential for private banking prospect. With Indonesian market potential, the demand for private banking is emerging. We will confirm this finding with the following section of results from structural model of conjectural equations.

Table 6. Estimation of The Effect of Credit Risk 1, Total Assets, and Cost Efficiency on Log of Private Banking Customers

	(13) OLS within Strategic Group	(14) Panel within Strategic Group	(15) Panel between Strategic Group	(16) Panel correction between Strategic Group	(17) Panel between strategic group with CMD	(18) Panel between strategic group with AKM
VARIABLES	lcust	lcust	lcust	Lcust	Lcust	lcust
Cost Efficiency	1.501	1.485	2.110**	1.476	1.814	1.507***
	(0.808)	(0.541)	(0.557)	(1.165)	(1.920)	(0.231)
Ln(Total Assets)	0.702	0.700	0.663*	0.646**	0.628	0.674***
	(0.127)	(0.157)	(0.271)	(0.265)	(0.205)	(0.0388)
Credit Risk 1	0.533	0.367	-0.644	-0.287	1.329	-0.478
	(3.549)	(6.184)	(3.861)	(6.357)	(11.81)	(1.044)
o.dy_2014	-					
dy_2015	0.130	-0.246	-0.269*	-0.176		
	(0.102)	(0.438)	(0.0918)	(0.379)		
dy_2016	0.265	-0.112*	-0.0966	-0.0656	0.278	0.167*
	(0.340)	(0.0117)	(0.0651)	(0.192)	(0.330)	(0.0893)
dy_2017	0.326	-0.0509	-0.00965	0.0487	0.301	0.266***
	(0.426)	(0.0853)	(0.117)	(0.151)	(0.631)	(0.0782)
dy_2018	0.368				0.646	0.291***
	(0.195)				(0.712)	(0.0817)
dy_2014		-0.375	-0.433*	-0.342		
		(0.314)	(0.158)	(0.300)		
o.dy_2018		-	-	-		
F_1					0.414	0.525
					(1.083)	(0.001)
F_2					0.229	0.392
					(1.071)	(0.002)
F_3					-0.154	-0.00923
					(1.305)	(0.007)
o.F_4					-	0
						(0)
Constant	-5.333	-4.898	-4.331	-3.893	-4.465	
	(2.254)	(3.524)	(4.421)	(5.078)	(3.292)	
Observations	2,725	2,725	2,725	2,725	1,725	.
R-squared	0.449	0.444	0.397	0.351	0.530	
Number of d_risk_w		2			2	
Number of s				8		
Number of cid			4			

Note: Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1; CMD = Classical Minimum Distance;

Table 7.Estimation of The Effect of Credit Risk 2, Total Assets, and Cost Efficiency on Log of Private Banking Customers

	(19) OLS within Strategic Group	(20) Panel within Strategic Group	(21) Panel between Strategic Group	(22) Panel correction between Strategic Group	(23) Panel between strategic group with CMD	(24) Panel between strategic group with AKM
VARIABLES	lcust	lcust	lcust	lcust	lcust	lcust
Cost Efficiency	0.757*	0.712*	1.177	1.131	0.741	0.802***
	(0.0981)	(0.0701)	(0.990)	(0.907)	(1.387)	(0.197)
Ln(Total Assets)	0.726	0.723	0.701*	0.652*	0.661	0.684***
	(0.225)	(0.222)	(0.278)	(0.328)	(0.368)	(0.0258)
Credit Risk 2	-6.515	-8.321	-8.263	-10.86	-1.913	-6.794***
	(4.662)	(5.095)	(7.581)	(9.508)	(3.933)	(1.752)
dy_2014	-0.255	-0.372	-0.405*	-0.545		
	(0.0974)	(0.136)	(0.158)	(0.292)		
dy_2015	-0.182	-0.289	-0.266*	-0.364*		
	(0.101)	(0.0767)	(0.0889)	(0.166)		
dy_2016	-0.0258	-0.118	-0.0749	-0.102	0.0758	0.115
	(0.126)	(0.118)	(0.0810)	(0.221)	(0.286)	(0.110)
o.dy_2017	-					
dy_2018	0.0642				-0.000936	0.173
	(0.0190)				(0.0821)	(0.111)
dy_2017		-0.0942**	-0.0334	-0.0465	-0.339*	0.00734
		(0.00532)	(0.125)	(0.225)	(0.0463)	(0.111)
o.dy_2018		-	-	-		
F_1					0.242	0.249
					(0.113)	(0.006)
F_2					0.310	0.303
					(0.491)	(0.004)
F_3					-0.512	-0.470
					(0.128)	(0.002)
o.F_4					-	0
						(0)
Constant	-5.064	-4.847	-4.680	-3.680	-4.354	
	(4.005)	(3.937)	(4.793)	(6.018)	(7.433)	
Observations	2,650	2,650	2,650	2,650	1,650	.
R-squared	0.455	0.453	0.399	0.363	0.468	
Number of d_risk_w		2			2	
Number of s				7		
Number of cid			4			

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8. Estimation of The Effect of Credit Risk 3*, Total Assets, and Cost Efficiency on Log of Private Banking Customers*

	(25) OLS within Strategic Group	(26) Panel within Strategic Group	(27) Panel between Strategic Group	(28) Panel correction between Strategic Group	(29) Panel between strategic group with CMD	(30) Panel between strategic group with AKM
VARIABLES	lcust	lcust	lcust	lcust	lcust	lcust
Cost Efficiency	0.589	0.690	1.213	0.756	0.817	0.678***
	(0.643)	(0.549)	(0.825)	(0.466)	(0.390)	(0.262)
Ln(Total Assets)	0.705*	0.747	0.669*	0.662**	0.583	0.708***
	(0.102)	(0.123)	(0.265)	(0.210)	(0.157)	(0.0295)
Credit Risk 3	-1.079	-0.353	-4.143*	-2.692	-4.050**	-1.539***
	(0.766)	(1.482)	(1.648)	(1.537)	(0.288)	(0.240)
o.dy_2014	-					
dy_2015	0.107	-0.0594	-0.205	-0.0652		
	(0.240)	(0.545)	(0.146)	(0.289)		
dy_2016	0.192	0.0594	-0.125	0.00791	0.493	0.329***
	(0.331)	(0.0443)	(0.121)	(0.103)	(0.195)	(0.0800)
dy_2017	0.217	0.0584	-0.111	0.0220	0.678	0.272***
	(0.387)	(0.0860)	(0.139)	(0.105)	(0.149)	(0.0822)
dy_2018	0.322				0.426	0.0791
	(0.439)				(0.109)	(0.0896)
dy_2014		-0.163	-0.375	-0.198		
		(0.274)	(0.241)	(0.257)		
o.dy_2018		-	-	-		
F_1					2.098	1.168
					(0.576)	(0.001)
F_2					1.813	0.868
					(0.467)	(0.002)
F_3					1.719	0.758
					(0.813)	(0.813)
o.F_4					-	0
						(0)
Constant	-4.391	-5.436	-1.932	-2.532	-2.159	
	(2.923)	(3.212)	(4.183)	(3.961)	(2.947)	
Observations	2,725	2,725	2,725	2,725	1,700	.
R-squared	0.452	0.473	0.463	0.421	0.604	
Number of d_risk_w		2			2	
Number of s				8		
Number of cid			4			

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9. Estimation of The Effect of Liquidity Risk *, Total Assets, and Cost Efficiency on Log of Private Banking Customers*

	(31) OLS within Strategic Group	(32) Panel within Strategic Group	(33) Panel between Strategic Group	(34) Panel correction between Strategic Group	(35) Panel between strategic group with CMD	(36) Panel between strategic group with AKM
VARIABLES	lcust	lcust	lcust	lcust	lcust	lcust
Cost Efficiency	1.352*	1.044	1.733*	0.988**	1.519	1.153***
	(0.124)	(0.409)	(0.695)	(0.300)	(0.504)	(0.185)
Ln(Total Assets)	0.649**	0.634*	0.554	0.654	0.463**	0.623***
	(0.0478)	(0.0664)	(0.350)	(0.452)	(0.0298)	(0.0233)
Liquidity Risk	-1.213	-0.172	-1.957	-1.395	-0.827	-0.212
	(1.190)	(2.116)	(0.962)	(1.895)	(2.957)	(0.234)
o.dy_2014	-					
dy_2015	0.133**	-0.0473	-0.264**	-0.0641		
	(0.00800)	(0.110)	(0.0777)	(0.278)		
dy_2016	0.265	0.0471	-0.106	0.0696	0.236	0.226***
	(0.0867)	(0.0647)	(0.0486)	(0.237)	(0.0474)	(0.0644)
dy_2017	0.329*	0.122	-0.0165	0.163	0.283***	0.305***
	(0.0504)	(0.189)	(0.103)	(0.222)	(0.000706)	(0.0704)
dy_2018	0.372				0.535***	0.0979
	(0.335)				(0.00501)	(0.0655)
dy_2014		-0.173	-0.422*	-0.176		
		(0.103)	(0.144)	(0.310)		
o.dy_2018		-	-	-		
F_1					0.876	0.791
					(0.961)	(0.001)
F_2					0.480	0.502
					(0.656)	(0.003)
F_3					0.209	0.266
					(1.066)	(0.005)
o.F_4					-	0
						(0)
Constant	-3.817**	-3.619	-1.593	-3.482	-1.145	
	(0.252)	(0.628)	(6.594)	(8.818)	(1.186)	
Observations	2,725	2,725	2,725	2,725	1,500	.
R-squared	0.460	0.385	0.423	0.345	0.374	
Number of d_risk_w		2			2	
Number of s				8		
Number of cid			4			

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10. Estimation of The Effect of Operational Risk *, Total Assets, and Cost Efficiency on Log of Private Banking Customers*

	(37) OLS within Strategic Group	(38) Panel within Strategic Group	(39) Panel between Strategic Group	(40) Panel correction between Strategic Group	(41) Panel between strategic group with CMD	(42) Panel between strategic group with AKM
VARIABLES	lcust	lcust	lcust	lcust	lcust	lcust
Cost Efficiency	1.118	1.098	1.675	1.710	1.347	0.953**
	(0.587)	(0.785)	(3.241)	(2.044)	(0.394)	(0.403)
Ln(Total Assets)	0.705*	0.692	0.699**	0.733**	0.661	0.659***
	(0.0647)	(0.138)	(0.202)	(0.240)	(0.146)	(0.0306)
Operational Risk	0.153	0.383	0.542	1.552	1.742	0.157
	(2.580)	(4.025)	(2.057)	(2.343)	(3.793)	(0.293)
dy_2014	-0.150	-0.292*	-0.344	-0.103		
	(0.0694)	(0.0407)	(0.203)	(0.258)		
dy_2015	-0.0671	-0.200	-0.232	-0.00172		
	(0.0466)	(0.131)	(0.103)	(0.223)		
dy_2016	0.00289	-0.0987	-0.158	0.101	0.503	0.130*
	(0.0344)	(0.312)	(0.0896)	(0.257)	(0.242)	(0.0738)
o.dy_2017	-					
dy_2018	0.162				0.232	0.231***
	(0.0997)				(0.0871)	(0.0834)
dy_2017		-0.117	-0.156	0.149	0.168	0.153**
		(0.188)	(0.0875)	(0.276)	(0.140)	(0.0747)
o.dy_2018		-	-	-		
F_1					0.446	0.286
					(0.346)	(0.001)
F_2					0.380	0.158
					(0.206)	(0.002)
F_3					-0.0766	-0.215
					(0.489)	(0.001)
o.F_4					-	0
						(0.003)
Constant	-5.458*	-5.150	-5.719**	-6.887*	-5.790	
	(0.740)	(1.700)	(1.169)	(3.424)	(1.611)	
Observations	2,700	2,700	2,700	2,700	1,575	.
R-squared	0.437	0.382	0.375	0.383	0.435	
Number of d_risk_w		2			2	
Number of s				8		
Number of cid			4			

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11. Estimation of The Effect of General Risk, *Total Assets, and Cost Efficiency on Log of Private Banking Customers*

	(43) OLS within Strategic Group	(44) Panel within Strategic Group	(45) Panel between Strategic Group	(46) Panel correctionbetween Strategic Group	(47) Panel between strategic group with CMD	(48) Panel between strategic group with AKM
VARIABLES	lcust	lcust	lcust	lcust	lcust	lcust
Cost Efficiency	1.074	1.133	1.499*	1.368	2.175***	1.367***
	(0.223)	(0.210)	(0.592)	(0.915)	(0.0168)	(0.256)
Ln(Total Assets)	0.639	0.625	0.585	0.598	0.596	0.595***
	(0.123)	(0.127)	(0.317)	(0.326)	(0.102)	(0.0305)
General Risk	15.19**	10.65	20.25	23.92**	32.62	12.41***
	(0.702)	(2.855)	(13.86)	(9.251)	(17.48)	(2.154)
o.dy_2014	-					
dy_2015	0.217**	-0.303	-0.241**	-0.148		
	(0.0107)	(0.1000)	(0.0745)	(0.174)		
dy_2016	0.349	-0.207	-0.0829	-0.00185	0.715	0.340***
	(0.180)	(0.268)	(0.0654)	(0.277)	(0.562)	(0.0879)
dy_2017	0.387**	-0.104	-0.0272	-0.000699	0.582	0.405***
	(0.0295)	(0.0623)	(0.110)	(0.135)	(0.281)	(0.0858)
dy_2018	0.444*				0.857*	0.534***
	(0.0680)				(0.0700)	(0.100)
dy_2014		-0.458*	-0.515*	-0.503**		
		(0.0707)	(0.208)	(0.173)		
o.dy_2018		-	-	-		
F_1					0.666	0.385
					(0.187)	(0.001)
F_2					0.488	0.178
					(0.507)	(0.003)
F_3					0.276	0.0987
					(0.338)	(0.004)
o.F_4					-	0
						(0)
Constant	-4.274	-3.498	-3.069	-3.334	-4.813	
	(2.028)	(2.066)	(5.528)	(5.743)	(1.233)	
Observations	2,725	2,725	2,725	2,725	1,650	.
R-squared	0.463	0.414	0.420	0.394	0.572	
Number of d_risk_w		2			2	
Number of s				8		
Number of cid			4			

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.3. Structural Estimation of Conjectural Variation

In the following paragraph, we are going to discuss about the results of estimation of equation (6) and (7) or we called as structural conjectural equation with Two Stage Least Square (2SLS), Three Stage Least Square (3SLS) and System General Method of Moment (SGMM) method. We estimate those system of equation into six type of risks. The results presents in the following Table 12 – 17.

The results informed us that structural model that especially with 2SLS and SGMM that incorporated risk factor on cost function and feed into supply and demand equation produce expected sign. Furthermore, 2SLS and SGMM produce more robust results as indicates by increasing parameter magnitude and reducing standard error. The sign inline with our equation in terms of basic equation of supply and demand such as price effect ($\hat{\theta}_{ij}$=lr_pb_ij) on demand equation has negative sign while MC has positive sign. On the other hand, 3SLS produce different

results against the theory supply and demand. Its indicates by marginal equation in 3SLS have wrong sign. We focus the results in 2SLS and SGMM than 3SLS.

Another facts that we are surprise with the results in unexpected sign of bank size (total assets). The sign suppose to positive sign that means increasing in total assets will increase on price of output of private banking. Contrary, the results has negative sign which means that increasing of total assets will reduce the price of private banking. If we looking at previous reduce form results such as risk behavior and behavior and market power (Table 11). The result is not surprising. At this moment along with emerging economies that indicate by increasing gross domestic per capita (GDP/Capita). The banks sample has been increase their assets to reach private banking market, and improve their cost efficiency (better management and tackle general risk management) by improving their assets.

In addition, in private banking market the negative terms also inform us that larger bank play fat cat strategy. If we looking at Fudenberg and Tirole (1984) taxonomy, fat cat strategy act stated that the larger banks creates its own barriers and produce relative cost of advantage to gain market power. The typical of large bank size in Indonesia usually they have large market segment and long standing experience. The customer loyalty and good reputation branding has shaped customer only familiar with larger banks.

Table 12. Estimation of Conjectural Variation Equation (1) According to Credit Risk 1

	(49)		(50)		(51)	
	2SLS		3SLS		SGMM	
VARIABLES	lr_pb	lcust	lr_pb	lcust	xp	xq
lta	-1.085***		-1.093***		-1.105***	
	(0.0390)		(0.0389)		(0.0334)	
lcust	1.714***		1.737***		1.686***	
	(0.0470)		(0.0470)		(0.0413)	
lgdpc	0.247***		0.252***		0.333***	
	(0.0514)		(0.0512)		(0.0474)	
r_d_macro	0.0986***		0.0997***		0.0848***	
	(0.0238)		(0.0237)		(0.0234)	
mc	0.000770	0.276***	-0.00262	0.276***	0.00134	0.590***
	(0.00169)	(0.00811)	(0.00168)	(0.00810)	(0.000994)	(0.0255)
lr_pb_ij		-0.231***		-0.231***		-0.834***
		(0.0764)		(0.0764)		(0.0813)
Observations	2,130	2,130	2,130	2,130	2,130	2,130
R-squared	0.907	0.360	0.904	0.360		
Hansen Test						

Standard errors in parentheses : *** p<0.01, ** p<0.05, * p<0.1, SGMM Estimated with Robust Two Steps Estimator
Note: lcust=ln(Customer of Private Banking); lta = ln(Total Assets); lgdpc = ln(GDP/capita), r_d_macro = deposit interest rate by central bank, lr_pb_ij (ln(r_i/r_j) = $\hat{\theta}_{ij}$.

Table 13. Estimation of Conjectural Variation Equation (1) According to Credit Risk 2

	(52) 2SLS		(53) 3SLS		(54) SGMM	
VARIABLES	lr_pb	lcust	lr_pb	lcust	xp	xq
lta	-1.085***		-1.093***		-1.104***	
	(0.0390)		(0.0389)		(0.0334)	
lcust	1.713***		1.736***		1.685***	
	(0.0470)		(0.0469)		(0.0412)	
lgdpc	0.247***		0.252***		0.332***	
	(0.0514)		(0.0512)		(0.0474)	
r_d_macro	0.0985***		0.0996***		0.0847***	
	(0.0238)		(0.0237)		(0.0233)	
mc	0.000823	0.276***	-0.00256	0.276***	0.00148	0.589***
	(0.00168)	(0.00810)	(0.00168)	(0.00809)	(0.000991)	(0.0255)
lr_pb_ij		-0.231***		-0.230***		-0.834***
		(0.0764)		(0.0764)		(0.0813)
Observations	2,130	2,130	2,130	2,130	2,130	2,130
R-squared	0.907	0.360	0.904	0.360		
Hansen Test						

Standard errors in parentheses : *** p<0.01, ** p<0.05, * p<0.1, SGMM Estimated with Robust Two Steps Estimator
Note: lcust=ln(Customer of Private Banking); lta = ln(Total Assets); lgdpc = ln(GDP/capita), r_d_macro = deposit interest rate by central bank, lr_pb_ij (ln(r_i/r_j) = $\hat{\theta}_{ij}$

Table 14. Estimation of Conjectural Variation Equation (1) According to Credit Risk 3

	(55) 2SLS		(56) 3SLS		(57) SGMM	
VARIABLES	lr_pb	lcust	lr_pb	lcust	xp	xq
lta	-1.085***		-1.093***		-1.104***	
	(0.0390)		(0.0389)		(0.0334)	
lcust	1.713***		1.736***		1.685***	
	(0.0470)		(0.0469)		(0.0412)	
lgdpc	0.247***		0.252***		0.333***	
	(0.0514)		(0.0512)		(0.0474)	
r_d_macro	0.0985***		0.0996***		0.0848***	
	(0.0238)		(0.0237)		(0.0233)	
mc	0.000847	0.277***	-0.00256	0.277***	0.00156	0.592***
	(0.00169)	(0.00812)	(0.00169)	(0.00812)	(0.000997)	(0.0255)
lr_pb_ij		-0.232***		-0.232***		-0.835***
		(0.0764)		(0.0763)		(0.0812)
Observations	2,130	2,130	2,130	2,130	2,130	2,130
R-squared	0.907	0.361	0.904	0.361		
Hansen Test						

Standard errors in parentheses : *** p<0.01, ** p<0.05, * p<0.1, SGMM Estimated with Robust Two Steps Estimator
Note: lcust=ln(Customer of Private Banking); lta = ln(Total Assets); lgdpc = ln(GDP/capita), r_d_macro = deposit interest rate by central bank, lr_pb_ij (ln(r_i/r_j) = $\hat{\theta}_{ij}$.

Table 15. Estimation of Conjectural Variation Equation (1) According to Liquidity Risk

	(58) 2SLS		(59) 3SLS		(60) SGMM	
VARIABLES	lr_pb	lcust	lr_pb	lcust	xp	xq
lta	-1.085***		-1.093***		-1.105***	
	(0.0390)		(0.0389)		(0.0334)	
lcust	1.714***		1.737***		1.686***	
	(0.0470)		(0.0470)		(0.0413)	
lgdpc	0.247***		0.252***		0.333***	
	(0.0514)		(0.0512)		(0.0475)	
r_d_macro	0.0986***		0.0997***		0.0850***	
	(0.0238)		(0.0237)		(0.0234)	
mc	0.000770	0.277***	-0.00263	0.277***	0.00133	0.591***
	(0.00169)	(0.00811)	(0.00168)	(0.00811)	(0.000996)	(0.0255)
lr_pb_ij		-0.232***		-0.231***		-0.834***
		(0.0764)		(0.0764)		(0.0813)
Observations	2,130	2,130	2,130	2,130	2,130	2,130
R-squared	0.907	0.360	0.904	0.360		
Hansen Test						

Standard errors in parentheses : *** p<0.01, ** p<0.05, * p<0.1, SGMM Estimated with Robust Two Steps Estimator
Note: lcust=ln(Customer of Private Banking); lta = ln(Total Assets); lgdpc = ln(GDP/capita), r_d_macro = deposit interest rate by central bank, lr_pb_ij (ln(r_i/r_j) = $\hat{\theta}_{ij}$.

Table 16. Estimation of Conjectural Variation Equation (1) According to Operational Risk

	(61) 2SLS		(62) 3SLS		(63) SGMM	
VARIABLES	lr_pb	lcust	lr_pb	lcust	xp	xq
lta	-1.084***		-1.092***		-1.105***	
	(0.0389)		(0.0388)		(0.0333)	
lcust	1.712***		1.735***		1.683***	
	(0.0469)		(0.0469)		(0.0411)	
lgdpc	0.246***		0.251***		0.335***	
	(0.0513)		(0.0511)		(0.0473)	
r_d_macro	0.0983***		0.0994***		0.0848***	
	(0.0238)		(0.0237)		(0.0233)	
mc	0.00102	0.276***	-0.00236	0.276***	0.00205**	0.582***
	(0.00168)	(0.00807)	(0.00167)	(0.00806)	(0.000996)	(0.0251)
lr_pb_ij		-0.234***		-0.233***		-0.840***
		(0.0764)		(0.0763)		(0.0807)
Observations	2,130	2,130	2,130	2,130	2,130	2,130
R-squared	0.908	0.361	0.904	0.361		
Hansen Test						

Standard errors in parentheses : *** p<0.01, ** p<0.05, * p<0.1, SGMM Estimated with Two Steps Estimator
Note: lcust=ln(Customer of Private Banking); lta = ln(Total Assets); lgdpc = ln(GDP/capita), r_d_macro = deposit interest rate by central bank, lr_pb_ij (ln(r_i/r_j) = $\hat{\theta}_{ij}$.

Table 17. Estimation of Conjectural Variation Equation (1) According to General Risk

	(64) 2SLS		(65) 3SLS		(66) SGMM	
VARIABLES	lr_pb	lcust	lr_pb	lcust	xp	xq
lta	-1.085***		-1.093***		-1.104***	
	(0.0389)		(0.0389)		(0.0334)	
lcust	1.713***		1.736***		1.685***	
	(0.0470)		(0.0469)		(0.0412)	
lgdpc	0.247***		0.252***		0.332***	
	(0.0514)		(0.0511)		(0.0474)	
r_d_macro	0.0985***		0.0996***		0.0848***	
	(0.0238)		(0.0237)		(0.0233)	
mc	0.000845	0.276***	-0.00254	0.276***	0.00154	0.591***
	(0.00168)	(0.00810)	(0.00168)	(0.00810)	(0.000992)	(0.0255)
lr_pb_ij		-0.231***		-0.230***		-0.832***
		(0.0764)		(0.0764)		(0.0813)
Observations	2,130	2,130	2,130	2,130	2,130	2,130
R-squared	0.907	0.360	0.904	0.360		
Hansen Test						

Standard errors in parentheses : *** p<0.01, ** p<0.05, * p<0.1, SGMM Estimated with Two Steps Estimator
Note: lcust=ln(Customer of Private Banking); lta = ln(Total Assets); lgdpc = ln(GDP/capita), r_d_macro = deposit interest rate by central bank, lr_pb_ij (ln(r_i/r_j) = $\hat{\theta}_{ij}$.

In each estimation of risk factors, it is confirmed that risk increased marginal cost and increase number of price of private banking. In demand equation the price difference terms (lr_pb_ij) associated with marginal cost as control variable of price difference decrease the quantity of private banking customer. This parameter confirm with our assumption that consumer will hold their private banking services along with risk mitigation preferences. The marginal cost properly reflected risk mitigation behavior of their investment. The terms demonstrates that increasing gap of price difference will reduce consumer due to increasing of risk.

The estimation shows that Operational Risk as the highest indicators that consumer will avoid private banking services. Then followed by Credit Risk 3, Credit Risk 2, Credit Risk 1, Liquidity Risk and General Risk. These results suggest that consumer requires basic information whether the bank has good management in their daily operational live. Credit Risk in the second row, is inline with our previous results that Credit Risk 3 and Credit Risk 2 as a major causes whether bank conducting good management or bad management to tackle their risk.

This statement confirmed as noted by Mishra and Meyer (2019) that private banking customer in emerging Asian is more risk appetite to increase their spread margin. The entire estimation from Table 12 – Table 17 shows that marginal risk that internalize risk significantly affect on number of customer on demand model. Increasing risk will increase price difference between bank and increase their marginal cost that led to decreasing their market power.

These tables inform us that internalizing risk on cost model is the dominant factor that affect on demand for customer and price competition of private banking in Indonesia. The price of private banking sector is affect by macro indicators such as increasing of GDP percapita and interest rate imposed by central bank. Hence, we can stated that the central bank rate policy affect on the level of price of private banking. When the central bank increases the basis point interest rate, this will affect on price of private banking positively and affect on private bank competition.

We incorporate the GMM parameters from Table 12 – Table 17 into equation (1) to measure Rotschild-Breshanan Index (CVI – Conjectural Variation Index). The competition index was produced according to each risk hence we have five CVI with different risk type. We need to illustrates whether CVI within and between strategic group have different competition behavior. In order to decompose the competition anatomy according to bank cluster. We calculated within competition behavior by calculating separate average statistic of CVI into universal bank, foreign bank, local bank, and sharia bank according to average statistic of CVI in every cluster. We measured between strategic competition by calculating average statistic in the entire sample. We depicted this CVI in Figure 1.

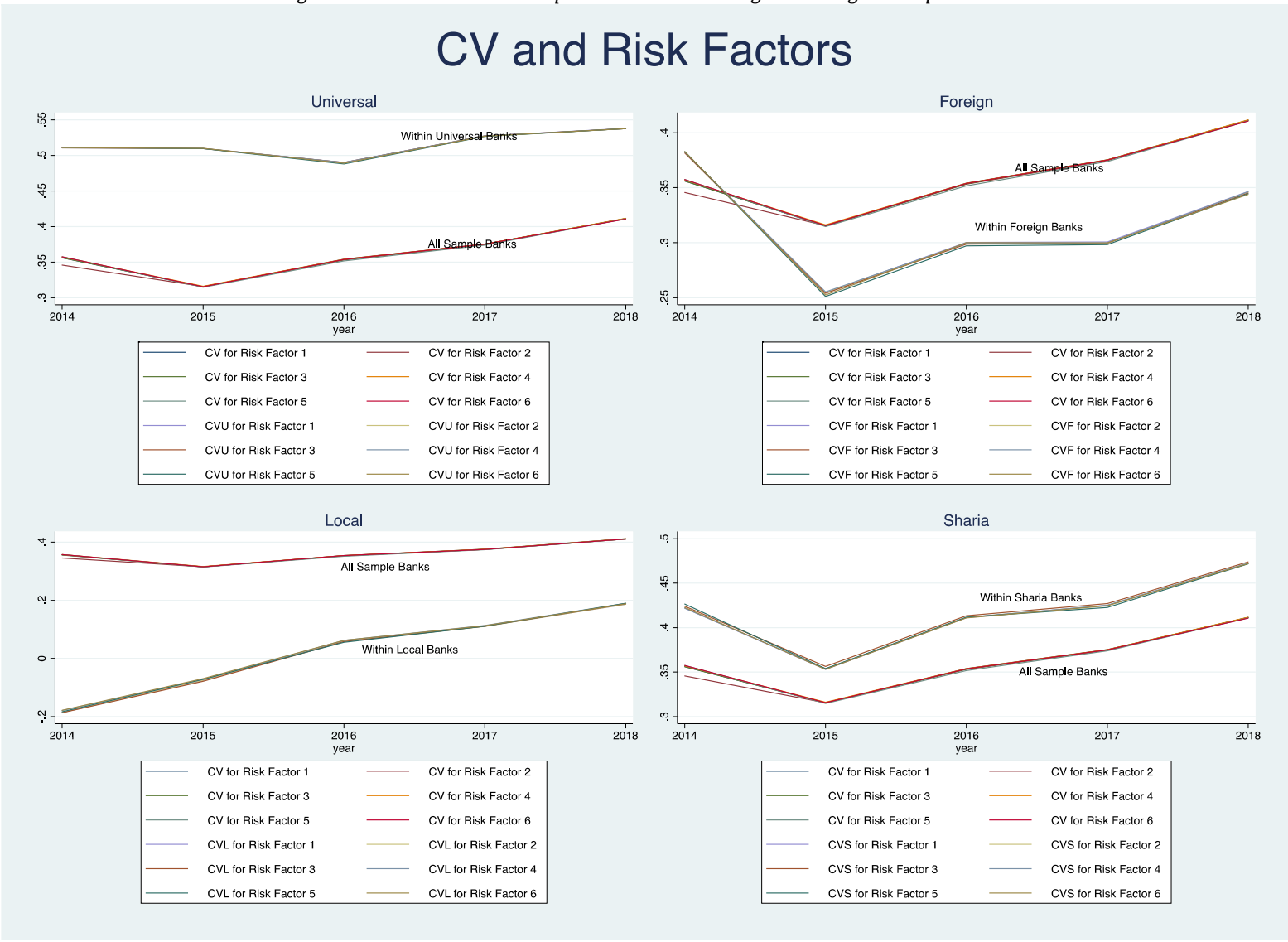
In Figure 1 between competition index is lower that within universal index, which means that the average of competition index in universal strategic group is higher than between group. Within universal group the competition is more fierce than national in average. This condition only apply within universal cluster than other cluster such foreign and local bank cluster. Whereas, sharia bank the competition higher than national average. In fact within group competition close to universal bank.

Furthermore, we portrayed the performance within and between bank by applying response curve according to Fudenberg and Tirole (1984) in the whole sample. We mapped the graph according to our results from GMM estimation in Table 12- Table 17. We retrieve predicted price of private banking and mapped into market curve. We produce fit line for average price of private banking in the entire sample period and produce average statistics. Moreover, we also produce average marginal cost according to our marginal cost estimation from total cost estimation from the entire sample period.

We depicted these variables in Figure 2, thereby we can distinguished accurately how the within group and between group are mapped into one single graph. We mapped bank code and their cluster to evaluate whether there is difference within and between group. In order to evaluate this results we should refer the pattern of risk and efficiency for each banks. For detail information of this pattern please see in appendix. We produce the graph that measure cost efficiency and risk factors for each sample bank.

In order to explain Figure 2, we can identified that incumbent firm dominate by larger banks (MND, BCA). If we looking at the performance of risk and efficiency in the Appendix. They enjoy low efficiency and bigger market share. The determinant of their market power based upon their risk management and cost efficiency. There is no significant retaliation of bank within universal (U) group, otherwise between strategic group, foreign bank (F) such as STC and OCN attempt to enter universal strategic group. Within strategic group, the second layer of universal bank (PMT, MEG, BTN, BKP) unable to compete with the incumbent. They unable to shift or brought the customer of private banking while most of the customer loyal to larger bank. The foreign bank attempt to penetrate the market with competitive price, in fact some of them have their market segment although in some extent the market share less than major player in universal bank. The competitive price of foreign (F) bank (STC Bank) higher than universal bank price. The price of private banking in foreign strategic group higher than universal strategic group. The price in foreign bank has higher rate than universal bank with limited market share as conducted by STC, while others (CTB, UOB, OCB) have similar price with universal banks strategic group.

Figure 1. Risk Factors and Response Curve According to Strategic Group Cluster



Note: Sce 1: Internalizing Risk Factor 1 into Cost Function and Conjectural Model; Sce 2: Internalizing Risk Factor 2 into Cost Function and Conjectural Model; Sce 3: Internalizing Risk Factor 3 into Cost Function and Conjectural Model; Sce 4: Internalizing Risk Factor 4 into Cost Function and Conjectural Model; Sce 5: Internalizing Risk Factor 5 into Cost Function and Conjectural Model; Sce 6: Internalizing Risk Factor 6 into Cost Function and Conjectural Model

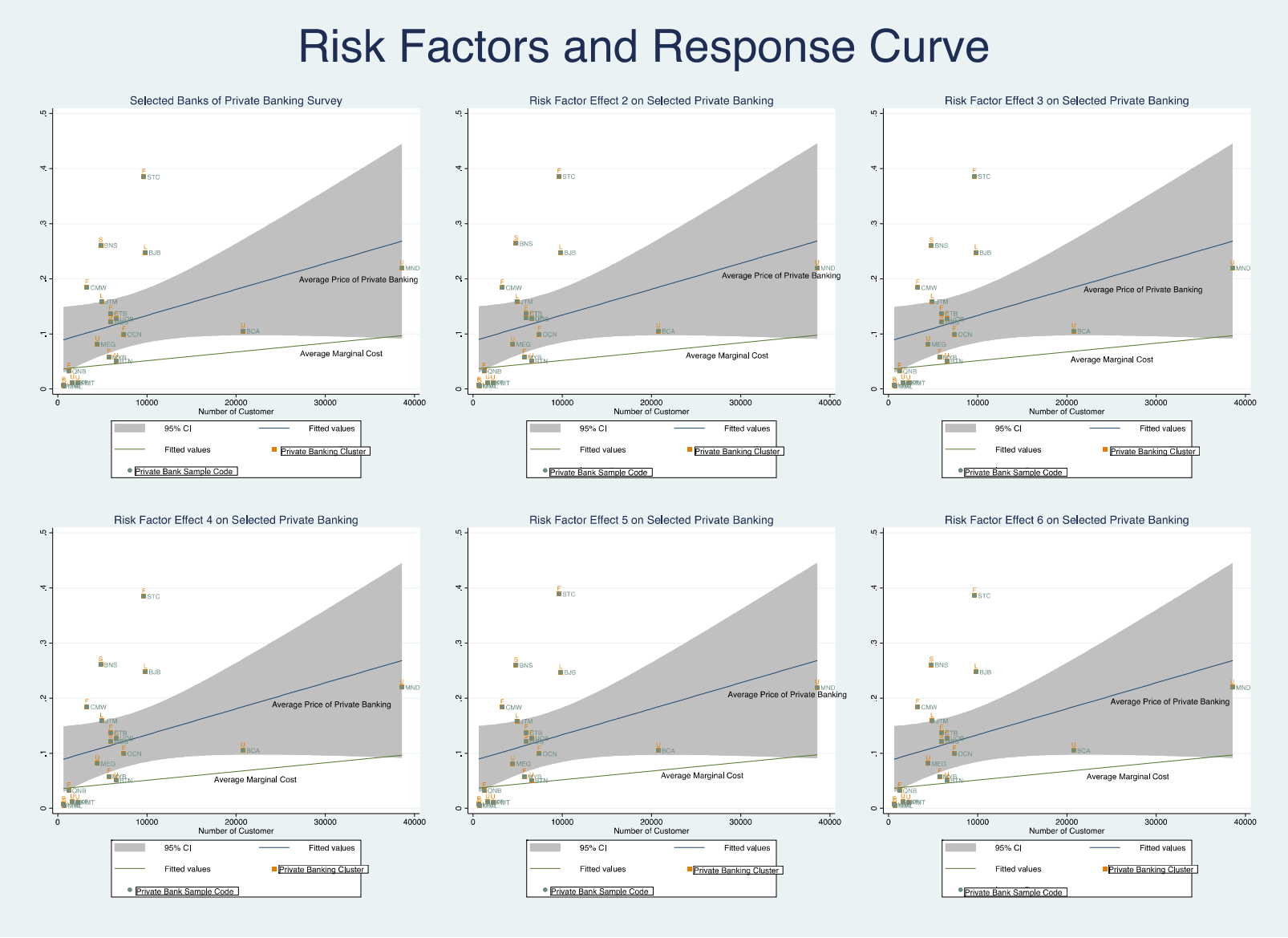
For local bank (L: BJB, JTM, SSL) , they creates different segment and promote local customer as their potential revenue for private banking. This is also works for sharia banking (MML, MDS, BNS) as well. If we looking at their efficiency performance and CVI sharia bank shaped with better performance rather than L and F banks. In the near future, sharia banking will attract more new customer along with better economic growth. If we looking at the estimation in Table 12-17, the growing of private bank customer will lead by rising of middle income class that indicates by increasing of income per capita.

If we looking the entire results, the external factors is strongly affect on strategic act of bank. Since we analyzed from risk and efficiency and conjectural model, every bank has heterogeneity performance. This differences affected by the external environment that face by the bank. We confirmed Bryane et al., (2015) argument that strategic cope of private banking in Indonesia similar with other Asian countries, that bank interactively cope with external environment by internalizing the risk through cost and affect on their price and output.

Basically, the strategic group of private banking in Indonesia is under investment during period of sample. There is no dramatic change of private bank in Indonesia offer with strong innovation or based upon over investment strategy. Although there is a fierce competition between bank, but the strategic asymmetric rivalry act in the market is soft. The universal bank strategically act by delivering common value for their private banking customer. This act, has been deter by foreign bank to offer with higher price than universal bank. Other bank such as local and sharia banking they tend to creates their own value by delivering value added product for their customer. This strategies is difference with universal and foreign bank. The local and sharia bank intent do creates unique market segment and value than universal banks.

Our results also support Mishra and Meyer (2019) argument that competition of private banking system in Asian market shaped of a higher appetite for risk, fragmented market and focus on capital preservation rather than wealth accumulation. The competition of private banking in Indonesia is dominated by incumbent firm that face by foreign bank. Within strategic group, incumbent create barrier by its efficiency and long standing experience of loyal customer. The incumbent play fat cat strategy while others play with lean and hungry outlook due to their lack of resources and inefficient. This competition characteristic support the quiet life hypothesis as suggested by Farrell and Shapiro, (1988) and bad management hypothesis as noted by Berger and DeYoung, (1997). Every bank play strong asymmetric strategy. This represent by different behavior between bank, neither adopt nor imitate for each bank face similar strategy for risk and cost efficiency.

Figure 2. Risk Factors and Response Curve



According to our hypothesis, it is stated that bank size, risk and return as mobility barrier for entrant to incumbent market. If we looking at the results, the size is no longer important factor to compete in private banking sectors. In private banking sectors, switching cost and risk management is a significant factor that attract private banking customers. How competition of private banking price with other private bank price (switching cost) is significant factor that increase private bank customer. We called this effect as "*private touch*" of private banking services. When the bank be able to offer competitive price by managing it cost and risk, the private bank customer will increase significantly.

4.4. Discussion

At this sub section, we have an argument that private banking in Indonesia is inefficient due to market environment. The fierce competition between bank in private banking market have attract various asymmetric strategies for each bank to compensate risk and efficiency. Universal bank with bigger asset size have attracted customer and dominated private banking sectors. If we connect with Fudenberg and Tirole (1984) taxonomy, this private bank company are fat cat while others are lean and hungry look. The incumbent play soft investment due to their assets and market power and stimulate its competitor by lean and hungry look.

The rivalry between private bank in Indonesia have different strategies to get market share, there is no adoption or imitation strategy of other bank to follow other banks. The banks are compete based upon their resources, and their market environment that shaped its performance. The asymmetric rivalry in each level of cluster is strongly asymmetric that indicates by risk and efficiency performance during period of observation. Its completely different with developed country case as noted by Más-Ruiz et al., (2014) for Spanish banking. The competition in Indonesia is fierce that requires specific strategies to be different with others. Every bank promotes to deliver different value to get different market segment. This strategies is advantage for the emergence of entrant bank to get new market segment that ensure is captive with less risk and cost.

The incumbent banks creates its own barriers and produce relative cost of advantage to gain market power. Its indicates by universal bank such as MND and BCA, their stable path efficiency led to fat cat strategy with under investment behavior. The long development of market segment and experience have benefited this bank to get loyal customer and attract new customer in the market.

The incumbent benefit their stability in the group and produce strong barrier for the entrant to enter the market. While the entrant penetrate the existing market, with under investment strategy they keep manage their risk to maintain their efficiency. The entrant unable to cope this strategy due to lack of resources improving their efficiency above the incumbent. Therefore, they act their strategies with lean and hungry look to enter the market either within or between strategic group.

In between group, such as local bank or sharia bank, the risk is depend upon its market environment that distinguished their performance and others. If we compare with theoretical definition, whether this group can enter into universal strategic group. The local require more assets and huge investment as well as better managing in risk and efficiency above universal performance to enter universal strategic group. Consequently, we can argue that stability of group structure of the incumbent determined by its risk and efficiency to maintain their size and customer.

If we looking at the behavior with others group such as foreign bank, this group has performed differently and more fluctuated rather than universal group. Some of bank such as CMW, HNB, RAB, OCN in fact have performed more competitive than other in their group and strongly competitive with universal bank. Hence, we can stated that foreign bank actually compete with universal bank rather than local or sharia bank.

5. Conclusion

In terms of risk and efficiency for private banking in Indonesia, risk, efficiency and switching cost are crucial variable to attract private banking customer. The competition of private banking in Indonesia dominated by incumbent firm. The incumbent of private banking based has larger size and long standing experience that represent by its market size. The risk and efficiency evolved over time and enjoyed by incumbent with fat cat taxonomy. The incumbent has abundant resource that can survive in different structure switching cost without compensating it fixed cost. In order to penetrate the market, the entrant play lean and hungry strategy in different market segment within strategic group. Otherwise, the foreign bank strategic group as between group attempt to enter incumbent market with offering higher cost strategy as noted on Figure 2.

Along with increasing of strong economic growth, every private bank targeted with different market segment. There is no significant investment of private banking strategy to attract more customer. The local and sharia banks has different private banking market. They will produce different market than universal and foreign banks. We confirm that competition of private banking in Indonesia dominate by higher risk appetite, fragmented market and focus on capital preservation rather than wealth accumulation.

Appendix A: Derivation of Conjectural Variation Equilibria for Private Banking Sectors

We have that each bank of i has profit (π_i) with revenue (r_i) and cost (c_i), bank received their revenue with Price (P_i) and Quantity (Q_i). Then firm performance of bank based upon

$$\pi_i = r_i - c_i$$
$$\pi_i = P_i \cdot Q_i - c(Q_i)$$
$$\pi_i = P_i \cdot Q_i = c(Q_i)$$

Applying first order condition we have

$$P(Q_i) + Q_i \cdot \frac{\partial P_i}{\partial Q_i} + \sum_{i \neq j}^{n} \frac{\partial Q_i}{\partial Q_j} \cdot \frac{\partial P_i}{\partial Q_i} = \frac{\partial C_i}{\partial Q_i}$$

After separating $\partial P_i \,/\, \partial Q_i$ we have

$$P(Q_i) + Q_i \cdot \frac{\partial P_i}{\partial Q_i}\left[1 + \sum_{i \neq j}^{n} \frac{\partial Q_i}{\partial Q_j}\right] = \frac{\partial C_i}{\partial Q_i}$$

where

$$\sum_{i \neq j}^{n} \frac{\partial Q_i}{\partial Q_j} = \begin{bmatrix} 1 & \frac{\partial Q_i}{\partial Q_j} \\ \frac{\partial Q_j}{\partial Q_i} & 1 \end{bmatrix}$$

An linearizing into retaliation between i and j become

$$\sum_{i \neq j}^{n} \frac{\partial Q_i}{\partial Q_j} = \left[\frac{\partial Q_i}{\partial Q_j} + \frac{\partial Q_j}{\partial Q_i}\right]$$

Therefore we have final conjectural variation equilibria

$$P_i(Qi) + Q_i \cdot \frac{\partial P_i}{\partial Q_i}\left[1 + \sum_{i \neq j}^{n} \frac{\partial Q_i}{\partial Q_j}\right] = C_i{}'$$

Where $C_i' = \frac{\partial C_i}{\partial Q_i}$, $P' = \frac{\partial P_i}{\partial Q_i}$ and $\theta = 1 + \sum_{i \neq j}^{n} \frac{\partial Q_i}{\partial Q_j}$, we can simplify

$$P_i + Q_i \cdot P_i{}' \cdot \theta_{ij}' = C_i{}' \quad \text{.....(A1)}$$

or we can move others terms to the left hand side.

$$P_i = C_i' - (Q_i \cdot P_i' \cdot \theta_{ij}{}') \text{.....(A2)}$$

Where $C_i{}'$ is cost function for private banking sector , it is estimated with translog cost function; $P_i{}'$ is price of output such as private bank rate for each bank, Q_i is demand for private bank. θ is conjectural parameters.

From equation (A2) we modified this equation into simultaneous demand and supply of private banking to get conjectural parameters as noted in equation (1). In order to get incorporate switching cost theory, we elaborated that second terms of equation ($Q_i \cdot P_i' \cdot \theta_{ij}{}'$) with small modification.

As we noted earlier that, we assumed that conjectural equation of A2 based upon consumer perspective, that the number of customer of private banking in bank -I and bank – j, as the number

of consumer equal to demand for private banking of consumers preferences. The consumer preferences are equal to the price that We can define that and conjectural parameters from customer perspectives of θ_{ij} that quantity is a separable function of price change (Shepard's Lemma)

$$\theta_{ij} = \frac{Q_i}{Q_j} = \frac{C_i}{C_j} = \frac{U_i}{U_j} = \frac{\partial(p_i)}{\partial(p_{j)}} = \hat{\theta}_{ij} \text{ ……..(A3)}$$

Where $\hat{\theta}_{ij} = p_i - p_j$, we can called as switching cost parameters. Another definition in equation A2, because we defined that $P = C$, we can defined that

$$P_i' = C_i'$$

Therefore we have revised equation (A2) become,

$$P_i = C_i' - (Q_i \cdot C_i' \cdot \hat{\theta}_{ij}) \text{ ……..(A4)}$$

Where Q is quantity of number private bank customer, and C' is marginal cost and $\hat{\theta}$ as switching cost parameter. We conduct this equation as our revised conjectural variation with consumer perspectives.

Appendix B: Risk and Efficiency

In order to connect between risk and efficiency we follow Hughes and Mester (1998) by estimating cost function that incorporate multiple output as well as risk indicators into the model. We employ translog cost function as a workhorse for estimating C' (marginal cost). The translog function consist of three simultaneously equations that is cost function, cost share, and financial capital.
The cost function (B1) we define as follows,

$$\begin{aligned}\ln C_i = \alpha_0 &+ \sum_i a_i \ln y_i + \sum_j a_j \ln w_j + \frac{1}{2}\sum_i\sum_j s_{ij} \ln y_i \ln y_j + \frac{1}{2}\sum_i\sum_j g_{ij} \ln w_i \ln w_j \\ &+ \sum_i\sum_j d_{ij} \ln y_i \ln w_j + f_k \ln k + f_q \ln q + f_\sigma \ln \sigma + \frac{1}{2} r_{kk} \ln k \cdot \ln k + r_{kq} \ln k \cdot \ln q \\ &+ r_{k\sigma} \ln k \ln \sigma + \frac{1}{2} r_{qq} \ln q \cdot \ln q + r_{q\sigma} \ln q \cdot \ln \sigma \\ &+ \frac{1}{2} r_{\sigma\sigma} \ln \sigma \ln \sigma + \sum_i h_{ki} \ln k \ln y_i + \sum_i h_{qi} \ln q \ln y_i + \sum_i h_{\sigma i} \ln \sigma \ln y_i \\ &+ \sum_i t_{kj} \ln k \ln w_j + \sum_i t_{qj} \ln q \ln w_j + \sum_i t_{\sigma j} \ln \sigma \ln w_j + b_\omega \ln \omega + \frac{1}{2} g_{\omega\omega} \ln \omega \ln \omega \\ &+ \sum_i g_{j\omega} \ln w_j \ln \omega + \sum_i d_{j\omega} \ln y_i \ln \omega + t_{k\omega} \ln k \ \ln \omega + t_{q\omega} \ln q \ \ln \omega + t_{\theta\omega} \ln q \ \ln \omega \\ &+ \epsilon\end{aligned}$$

The market share function (B2)

$$S_j = b_j + \sum_i g_{ij} \ln w_i + \sum_i d_{ij} \ln y_i + t_{kj} \ln k + t_{qj} \ln q + t_{\theta j} \ln \theta + g_{\omega j} \ln \omega + \xi_i$$

The capital function (B3)

$$\ln k = A_0 + \sum_i A_i \ln y_i + \sum_i B_j \ln w_j + B_\omega \ln \omega \ + R_q \ln q + R_\sigma \ln \sigma + R_m \ln m + \sum_i R_i \ln p_i + v$$

Where C_i is cost variable, y_i is output that consist of lending, deposit, private banking; w_j is price of input, ω is bank specific risk-free rate of interest (Central Bank Rate), k is financial capital, q is quality; σ is risk, m is other revenue from interest; S_j is cost share of output over input; ϵ,v,ξ are normally distributed terms.

The efficiency was estimated $TE_i = \exp\left(-(\ln C_i - \ln \widehat{C}_\iota)\right)$

For complete of results of translog function estimation and cost efficiency we, presents in the following tables.

Table A. 1. Risk Factors 1, 2, 3 and Translog Cost Function

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Risk Factor 1			Risk Factor 2			Risk Factor 3	
VARIABLES	frontier	share1	share2	frontier	share1	share2	frontier	share1	share2
pl	0.404***	-0.0400***	-0.0617***	0.452***	-0.0482***	-0.0319*	0.550***	-0.0546***	-0.0266
	(0.0789)	(0.0102)	(0.0198)	(0.0758)	(0.00923)	(0.0193)	(0.0727)	(0.00869)	(0.0185)
pk	-0.497**	-0.0327***	-0.112***	-0.384*	-0.0402***	-0.0887***	-0.279	-0.0438***	-0.0854***
	(0.201)	(0.00638)	(0.0121)	(0.223)	(0.00535)	(0.0110)	(0.220)	(0.00504)	(0.0105)
prisk	0.303*	0.303*	-0.976***	0.141	0.141	-0.891	-0.180***	-0.180***	0.215***
	(0.154)	(0.154)	(0.293)	(0.290)	(0.290)	(0.597)	(0.0326)	(0.0326)	(0.0680)
plpl2	-0.0400***			-0.0482***			-0.0546***		
	(0.0102)			(0.00923)			(0.00869)		
pkpk2	0.126***			0.0853***			0.0875***		
	(0.0179)			(0.0144)			(0.0148)		
crrisk2	-20.09**			-6.324			-1.051		
	(7.920)			(24.94)			(1.221)		
ly12	-0.127***			-0.0737**			-0.0783*		
	(0.0302)			(0.0337)			(0.0472)		
ly22	0.0631**			0.0203			0.0160		
	(0.0286)			(0.0319)			(0.0449)		
ly32	-0.0189***			-0.0186***			-0.0191***		
	(0.00566)			(0.00474)			(0.00500)		
plpk	-0.0327***			-0.0402***			-0.0438***		
	(0.00638)			(0.00535)			(0.00504)		
ply1	0.141***			0.0889**			0.0935*		
	(0.0353)			(0.0405)			(0.0536)		
pky1	0.0659***			0.0455*			0.0259		
	(0.0204)			(0.0239)			(0.0236)		
risky1	0.786*			-0.913			0.0356		
	(0.444)			(1.286)			(0.186)		
ply2	-0.0667*			-0.0247			-0.0312		
	(0.0344)			(0.0396)			(0.0515)		
pky2	-0.0146			-0.0341			-0.0154		
	(0.0213)			(0.0233)			(0.0239)		
risky2	-1.516***			0.819			0.180		
	(0.497)			(1.436)			(0.215)		
ply3	0.0150**			0.0198***			0.0247***		
	(0.00639)			(0.00568)			(0.00538)		
pky3	0.0166			0.0495***			0.0474***		
	(0.0134)			(0.0114)			(0.0122)		
risky3	0.704***			0.131			-0.100		
	(0.191)			(0.569)			(0.0695)		
ly3		0.0150**	0.0160		0.0198***	0.00218		0.0247***	-0.00629
		(0.00639)	(0.0123)		(0.00568)	(0.0118)		(0.00538)	(0.0113)
Constant	4.501***	0.404***	1.141***	4.065***	0.452***	0.905***	3.174***	0.550***	0.866***
	(0.747)	(0.0789)	(0.151)	(0.707)	(0.0758)	(0.158)	(0.679)	(0.0727)	(0.154)
Observations	108	108	108	105	105	105	108	108	108
R-squared	0.944	0.354	0.505	0.955	0.374	0.450	0.951	0.467	0.496

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table A. 2.The Effect of Risk Factor 4 on Translog Cost Function

	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
		Risk Factor 4			Risk Factor 5			Risk Factor 6	
VARIABLES	frontier	share1	share2	frontier	share1	share2	frontier	share1	share2
pl	0.638***	-0.0590***	-0.00122	0.416***	-0.0548***	-0.0248	0.00536	-0.00443	0.0176
	(0.0878)	(0.00945)	(0.0185)	(0.0670)	(0.00835)	(0.0183)	(0.0633)	(0.00729)	(0.0223)
pk	-0.0136	-0.0479***	-0.0679***	-0.483**	-0.0452***	-0.0836***	-0.417	0.00307	-0.0564***
	(0.233)	(0.00569)	(0.0107)	(0.223)	(0.00484)	(0.0104)	(0.270)	(0.00512)	(0.0156)
prisk	-0.178***	-0.178***	0.434***	0.207***	0.207***	-0.239***	0.501***	0.501***	0.389***
	(0.0436)	(0.0436)	(0.0850)	(0.0324)	(0.0324)	(0.0693)	(0.0434)	(0.0434)	(0.133)
plpl2	-0.0590***			-0.0548***			-0.00443		
	(0.00945)			(0.00835)			(0.00729)		
pkpk2	0.0898***			0.0910***			0.0838***		
	(0.0138)			(0.0139)			(0.0154)		
crrisk2	-3.683**			-0.473			5.413***		
	(1.508)			(1.141)			(1.213)		
ly12	-0.0850			-0.0740			-0.104***		
	(0.0564)			(0.0467)			(0.0312)		
ly22	0.0336			0.0139			0.0435		
	(0.0518)			(0.0431)			(0.0299)		
ly32	-0.0210***			-0.0232***			0.00357		
	(0.00489)			(0.00443)			(0.00339)		
plpk	-0.0479***			-0.0452***			0.00307		
	(0.00569)			(0.00484)			(0.00512)		
ply1	0.0766			0.0914			0.132***		
	(0.0665)			(0.0589)			(0.0392)		
pky1	0.0501**			0.0380*			-0.0171		
	(0.0229)			(0.0226)			(0.0234)		
risky1	0.640**			-0.257			-0.298*		
	(0.272)			(0.236)			(0.167)		
ply2	-0.0160			-0.0195			-0.0684*		
	(0.0641)			(0.0567)			(0.0385)		
pky2	-0.0562**			-0.00345			0.0197		
	(0.0229)			(0.0271)			(0.0225)		
risky2	-0.597**			-0.0602			0.373**		
	(0.248)			(0.242)			(0.186)		
ply3	0.0219***			0.0239***			0.00337		
	(0.00558)			(0.00512)			(0.00411)		
pky3	0.0519***			0.0385***			0.0137		
	(0.0111)			(0.0116)			(0.0132)		
risky3	0.0815			0.213***			-0.330***		
	(0.0567)			(0.0668)			(0.0660)		
ly3		0.0219***	-0.00795		0.0239***	-0.00674		0.00337	-0.0184
		(0.00558)	(0.0106)		(0.00512)	(0.0112)		(0.00411)	(0.0125)
Constant	2.382***	0.638***	0.491***	4.409***	0.416***	1.031***	8.747***	0.00536	0.489**
	(0.818)	(0.0878)	(0.173)	(0.640)	(0.0670)	(0.146)	(0.521)	(0.0633)	(0.194)
Observations	108	108	108	108	108	108	108	108	108
R-squared	0.950	0.408	0.553	0.952	0.514	0.506	0.994	0.730	0.440

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure A- 1. Cost Efficiency and Risk Factor 2 Period 2014 – 2018 across Banks Sample

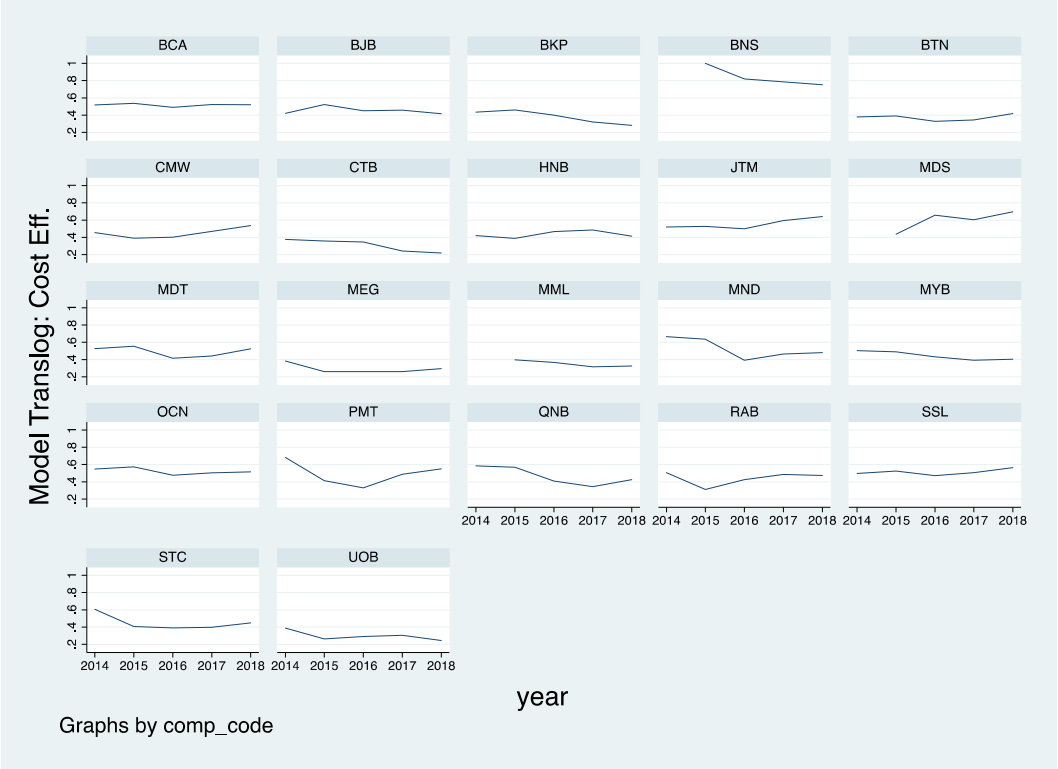


Figure A- 2. Cost Efficiency and Risk Factor 1 Period 2014 – 2018 across Banks Sample

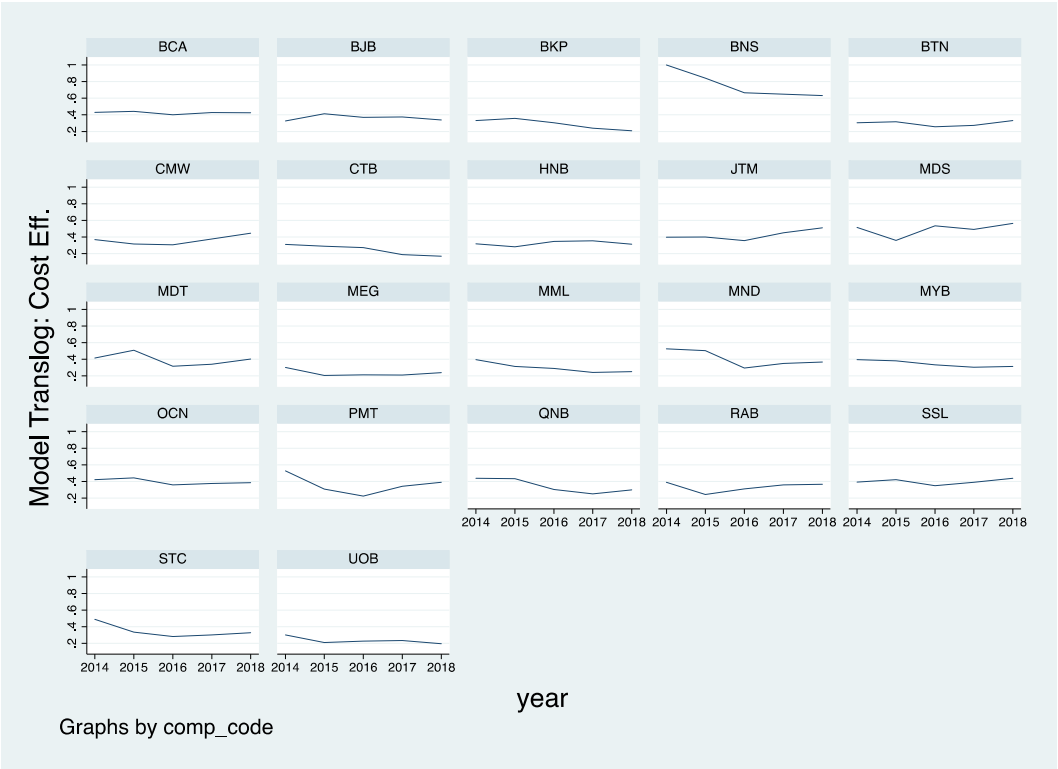


Figure A- 3. Cost Efficiency and Risk Factor 3 Period 2014 – 2018 across Banks Sample

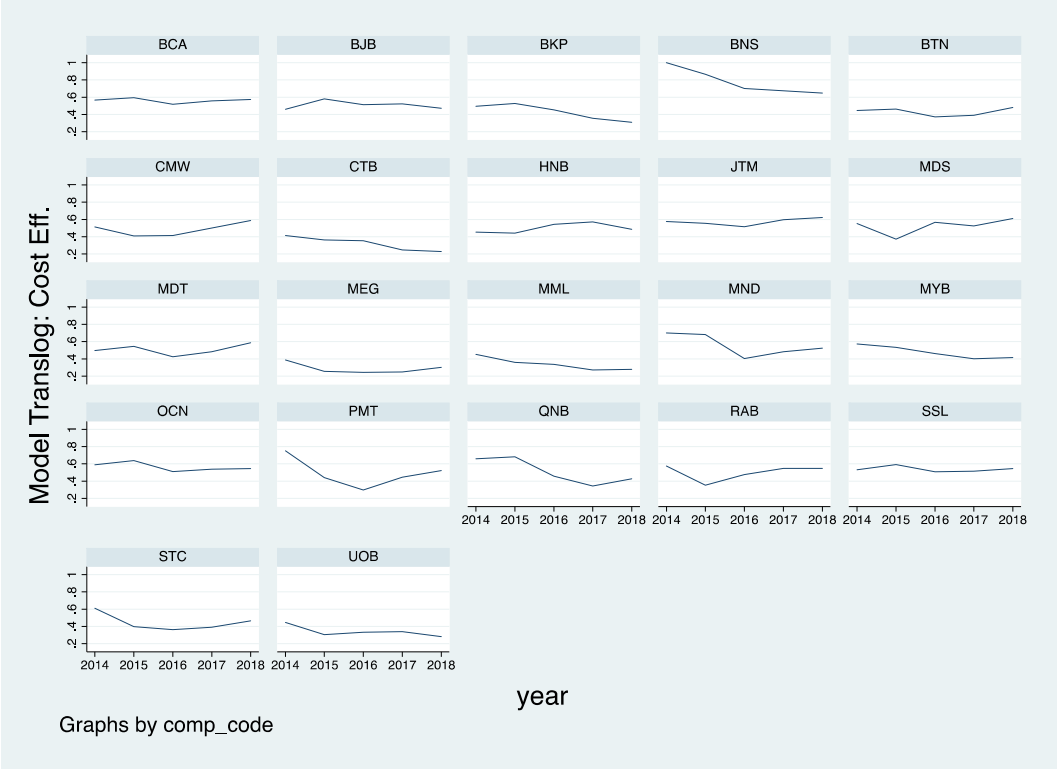


Figure A- 4. Cost Efficiency and Risk Factor 4 Period 2014 – 2018 across Banks Sample

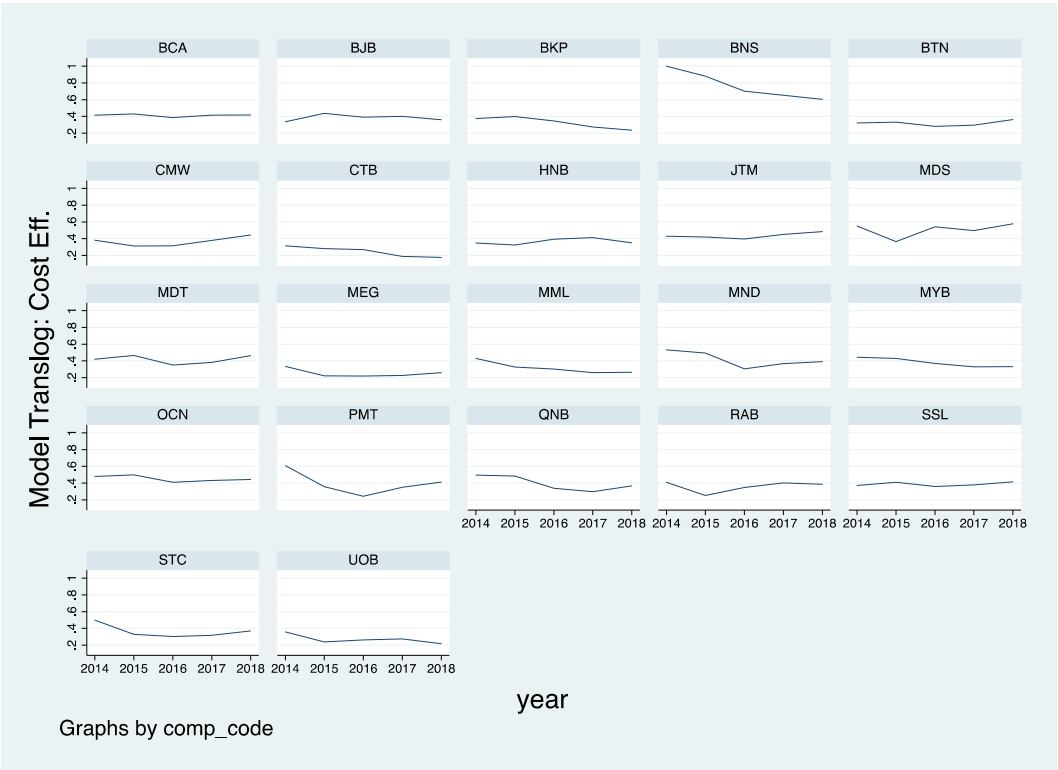


Figure A- 5. Cost Efficiency and Risk Factor 5 Period 2014 – 2018 across Banks Sample

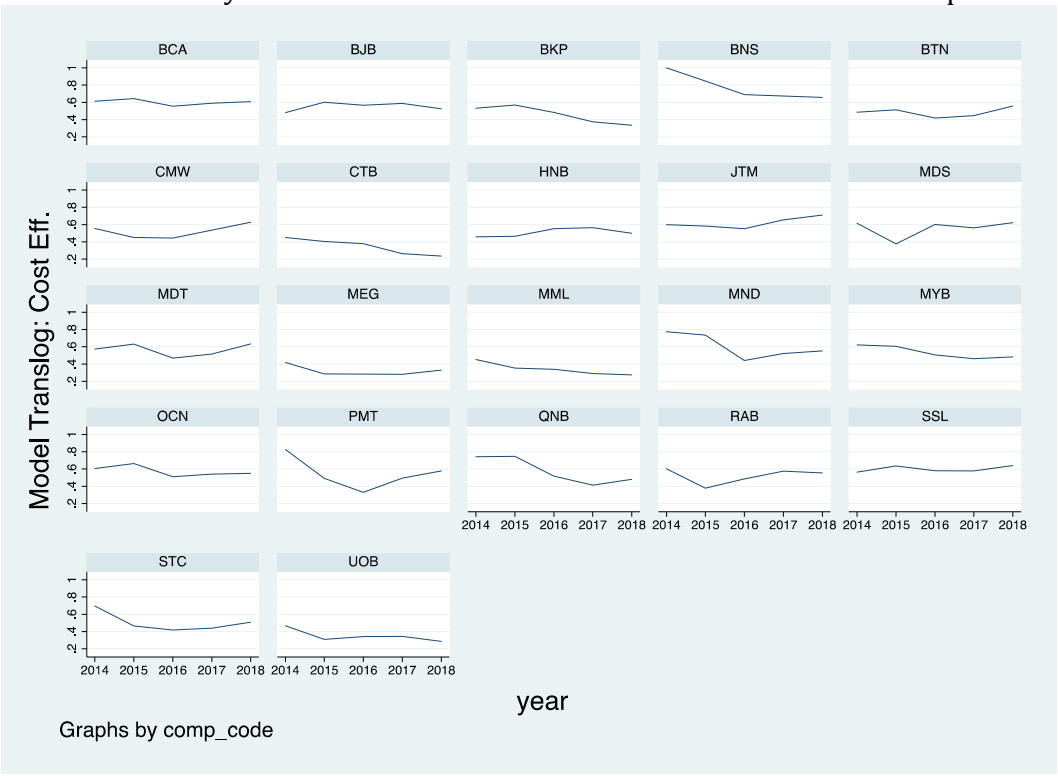


Figure A- 6. Cost Efficiency and Risk Factor 6 Period 2014 – 2018 across Banks Sample

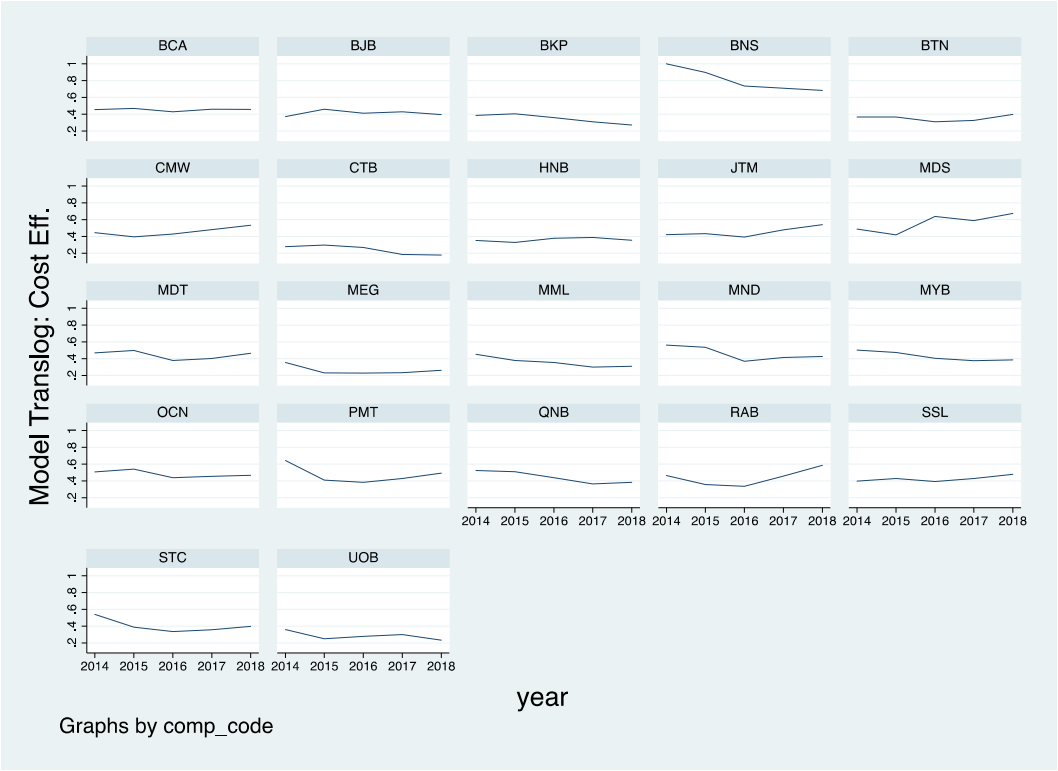
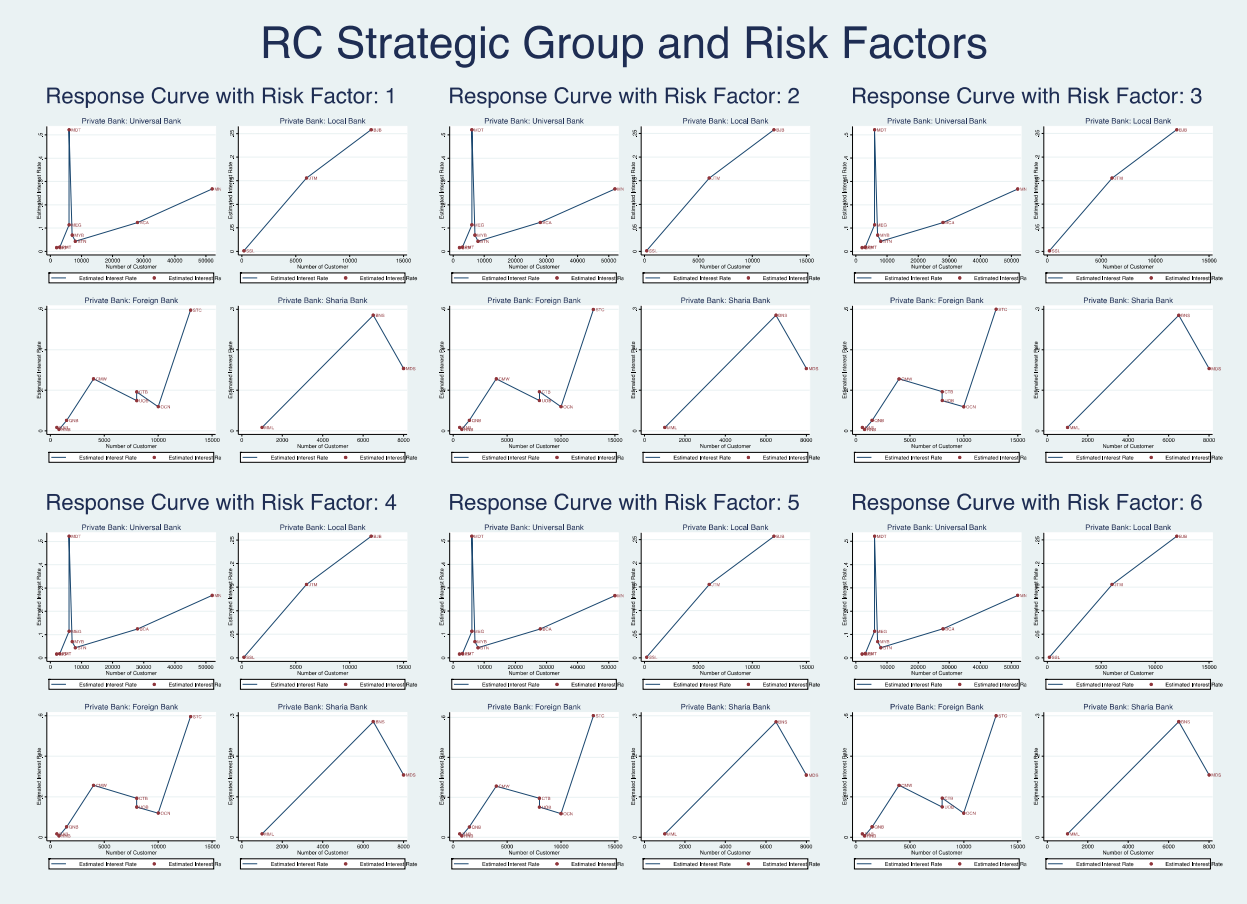


Figure A- 7. Response Curve Within Strategic Group and Risk Factors



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